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ELECTRICAL REVIEW.

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THE I.M.E.A. CONVENTION.

ON Tuesday next week the Annual Convention of the Municipal Electrical Association will be commenced at the Institution of Electrical Engineers, London. It is seven years since last the Convention was held in the Metropolis, and we can assure the members that they may count upon a cordial welcome and excellent entertainment. Although the Association is not numerically strong, it undoubtedly represents the great bulk of the municipal supply undertakings in this country, and therefore its proceedings are vested with an importance which renders the Convention one of the principal events in the calendar of the electrical year.

Of the papers to be discussed one cannot say much at present; though fewer in number than usual, they touch on matters of great interest at the present time, and ought to lead to considerable discussion. Dr. Ferranti's paper on "Prime Movers" will, we believe, somewhat disappoint those engineers who have been craving for information as to the highly-superheated steam turbine; Mr. Christie's paper describes a useful development in the shape of a water filtering plant for the cooling air, in connection with turbo-generators; and the paper by Messrs. Watson and Mitchell deals with the electric battery vehicle—a subject which is of the greatest importance to central station engineers at the present time. In view of the progress which the authors' firm is making with the Edison battery vehicle in this country, and the demonstration of various types of electrical vehicle which follows the reading of this paper, it is to be hoped that the visitors will be stimulated into displaying rather more practical interest in the subject in the future, than has been the case in the past. A most urgent matter is the standardisation of charging voltages and appliances, and we trust that the opportunity will be seized to arrive at a decision on this point.

But it is not only with the reading of papers that the Convention is concerned; visits have been arranged to the historic Deptford generating station, the West Ham Corporation's electricity works, the Chelsea Underground Railway power station (which we illustrate in this issue), and to the Chingford Reservoir, to view the celebrated Humphrey pumps. Many of the visitors to Kingston-on-Thames will, no doubt, find much to interest them in the horizontal Diesel generating plant recently installed in the Corporation's electricity works, a brief illustrated description of which appears in this issue.

On this occasion the proceedings will be conducted partly *in camera*, the discussion on the Electric Lighting Bill promoted by the Association, and on Electric Heating and Cooking, being restricted to Members and Associates. We have received a copy of the Bill from the hon. secretary, Mr. H. Faraday Proctor, it having been introduced on Wednesday last week; most of its provisions are of a non-

contentious nature, and are likely, if approved by Parliament, to prove beneficial to the industry, but there is one clause which is sure to arouse the bitter opposition of the electrical contractors—the familiar clause which confers full powers upon the local authorities to provide, sell, let for hire, and fix, repair, maintain and remove electric lines, fittings, apparatus and appliances for all purposes. The only restrictions imposed upon them by the clause are that the local authorities shall not manufacture, shall confine their activities to their own areas and their own consumers, shall adjust the charges so as to cover all expenditure (including capital charges), and shall separately show the charges made for such work on demand notes, and the expenditure and receipts in their published accounts. Similar powers are conferred upon companies by another clause.

It will be seen that if these powers are granted, the local authorities will be enabled to enter into direct competition with the contractors, and the latter will oppose the clause on the ground that such competition, supported by the rates to which they contribute, is unfair. On the other hand, the municipalities will claim that, having been authorised by the State to embark upon the supply of electricity, they are entitled to the possession of full power to conduct the business on the most efficient lines, and not improbably the matter will end in a dead-lock, as usual. It is most unfortunate that this miserable controversy cannot be settled by agreement between the respective parties. We have often urged the desirability of compromise, and the fact that this can be achieved is strongly suggested by the harmonious co-operation which obtains in several towns where the municipality has succeeded in securing the powers in question. It is by no means too late to bury the hatchet even now, and we sincerely trust that the subject will be discussed by the M.E.A. with "Conciliation" as the text. Compromise demands concession from both sides. The contractors do not wish to clog the wheels of progress, and the municipalities do not wish to ruin the contractors. Surely they can agree as to their respective spheres, and arrive at a reasonable division of labour?

Another clause empowers the undertakers to provide showrooms, hold exhibitions, and carry on publicity schemes, all very laudable objects. It is alleged that the municipalities are at present unable to contribute to the funds of the Publicity Committee, for example, and that the latter is thereby crippled for lack of money. Whether this is the fundamental cause of the notorious failure of the Committee to exert any appreciable influence upon the progress of the industry is open to question; we fear the trouble lies deeper, and that the only remedy for the disease with which it is afflicted is that of dissolution.

Clause 4 authorises the sale of by-products, and Clause 5 the imposition of a minimum annual charge for a stand-by supply of energy. In other clauses power is taken to pay subscriptions to associations, such as the M.E.A., and the expenses of members attending conferences, provisions which are certainly highly desirable in the public interest. One clause deals with the allocation of surplus revenue to the purposes of the undertaking, instead of carrying it to the credit of the local rates; the intention is good, and the policy is one which we have long advocated—but surely an Act of Parliament is not necessary to allow it to be carried out. Other clauses facilitate the borrowing of money for working capital to a limited extent without the trouble and expense of an inquiry, and enact minor provisions in connection with the conduct of the business. The joint exercise of the powers to supply fittings, &c., and to carry on publicity campaigns with other bodies or persons is provided for, and this may contain the germ of a working agreement with the contractors.

THE LEAD MARKET.

One of the most pronounced and striking features in the metal markets during the gloom in evidence last week was the firmness of lead, the price of which hardly flickered, even when tin and copper were pressed for sale at continually weakening figures. The reason was, of course, that the intrinsic position of the metal is one of wholly exceptional strength, the causes operating in connection with which place the article in a category by itself. The consumption of lead naturally increased in common with that of all other metals during the recent period of exceptional industrial activity, but for reasons quite apart from those operating elsewhere (except in a limited degree as regards copper), there has been a reduction in the output, and it is this factor which has placed lead on the very strong foundations seen to-day. The whole position practically arises out of the long-drawn-out revolutionary disturbances in Mexico. This country is reckoned as the fourth largest producer of the metal, occupying this position for a number of years up to 1911, the returns for which year are the latest at present available; the output for 1909 was 113,000 tons, for 1910 115,000 tons, and for the following year 118,000 tons.

What the production will prove to have been last year is merely a matter of surmise, but there is not the slightest doubt that this year it has been very seriously reduced, owing to the revolution, the railways being cut, the transport of fuel, ores, and general supplies to the smelters being stopped, and the forwarding of lead from the smelters to the coast for shipment to Europe being suspended, and these conditions still continue in practically full force. The troubles will also be reflected in a falling-off in the United States lead production, for very large quantities of lead ore and argentiferous lead are sent from Mexico to be treated at United States plants, the total in 1911 being about 75,000 tons in soft lead contents.

For a very long time now, the Mexican smelters in the Torreon district have been practically at a standstill, and even though a small quantity of metal was got through from Torreon to Tampico last week for shipment to Europe, the general situation gives cause for the utmost anxiety to those who have been relying upon the Mexican product for their supplies of raw material. The output of the largest smelter at Torreon is taken by a leading firm of British lead manufacturers, and their buying of metal to replace the Mexican supply, has at times had an important influence on prices in the London market. The restriction of supplies has, indeed, been felt very severely, and the position does not seem to be getting any easier, for every ton of lead is swept up as soon as it comes in; the prospect is exceedingly uncomfortable for those consumers who have not had the foresight, or the proper knowledge, with which to gauge the probabilities of market happenings. It is to be feared that there is too often, on the part of even large users of commodities, an indifference to the course of commercial currents directly affecting their interests, an indifference which at times involves them in difficulties which could have been avoided easily enough, but which if neglected prove costly, and on occasion impossible of repair. Ultimately, of course, the situation in lead will be relaxed, but that can hardly occur until the normal working conditions are restored in Mexico, and the date of that may be far off even yet, though one naturally hopes for the best. Meanwhile, consumers who have not provided for their needs stand in an unenviable

position, because lead for immediate and near delivery commands an almost prohibitive price.

Consumers are very distrustful of lead at £20 a ton and upwards, and truly that is a high price. The average price of soft foreign lead was £17 15s. 10d. in 1912, £13 19s. 2½d. in 1911, £12 19s. in 1910, and £13 1s. 8d. in 1909, but in 1907, the boom year, it was £19 1s. 9d., while in 1902 it was no more than £11 5s. 3d. The highest figure reached was £23 15s. a ton in September of last year, and the lowest £9 in 1894. This year's monthly averages work out as follows with comparisons for the two previous years.

	1913.	1912.	1911.
January	£17 1 11	£15 11 2	£13 0 8 a ton.
February... ...	16 8 5	15 13 9	13 1 11 ,,
March	15 19 8	15 19 8	13 2 11 ,,
April	17 8 10	16 6 6	12 18 5 ,,
May	18 14 3	16 10 2	12 19 2 ,,

No doubt the spirit of caution is a virtue, even with the Mexican trouble looming large, but the point must be kept in mind in considering the position that one of these days things in Mexico will settle down, and when the news comes that the country's political troubles are over, one of the first events will be a readjustment of lead prices in consonance with the altered position. For the time being, however, the consuming trades have been pretty hard hit, and in more than one direction a restriction of operations is now in force, users not having bought ahead or against contracts, in a measure sufficient to protect themselves, and being either unable or unwilling to purchase at current figures. The supplies coming in from abroad are very moderate, and neither Spain nor Australia is increasing output to an extent sufficient to fill the gaps left by the shortage from Mexico. Further, Australia has had labour troubles to face which have tended to accentuate the stringency of the position. Then, again, consumption has increased very largely in the Far East, and important quantities of lead which formerly came to London are now shipped direct from Australia to Japan and China, while a good deal of Russia's requirements is now dispatched direct from Spain to St. Petersburg, all of which tends to restrict the tonnage of material coming to this country. In the long run, it makes no difference to British consumers, but it does tend at times to narrow the market for buyers. If ever there were an excess of supplies shipped, it would no doubt be London which would provide the temporary home for metal waiting for a market, when prices would naturally be expected to suffer. The anticipation that a period of lessened stringency is not very far off is entertained, is shown clearly enough by the fact that while the price of June shipment lead is over £20 a ton, that of August is only £19 7s. 6d. The discount reflects the market's estimate of the chances of a restoration of reasonable working conditions in the areas of unrest. Viewing the metal markets as a whole the tendency at present appears to be towards a lower level, not only because trade is thought to be waning, but also because finance has developed some unsound spots, and because trouble of this kind always reacts immediately upon public confidence, and through this, on national spending capacity in every direction, both public and private. It is too much to hope when once fairly normal conditions are restored in Mexico, that lead will prove a law to itself. In any event, consumers regard lead at £20 a ton with a suspicion born of experience, and buying is restricted.

Guaranteed Wiring.

WE referred some time ago to a proposal of the Electrical Contractors' Association to guarantee the work of its members. The proposal has not yet been translated into a definite scheme, but a report has been made by a Sub-Committee of the Association formulating certain definite suggestions which it is proposed should be incorporated in the scheme.

Briefly, these are (1) that every member of the Association shall undertake to carry out all his indoor contracts within the British Isles in strict conformity with the rules of the Institution of Electrical Engineers, except where some other standard is specified by the purchaser; (2) that the Association shall indemnify the employer of any member against bad workmanship or materials supplied by such member, subject to certain limitations; (3) that any member failing to remedy defective work after being called upon by the Association to do so shall at once cease to be a member of the Association.

A question which naturally suggests itself is, who is to be the judge? Many members might conceivably object to the judgment of a brother-member or a committee of members who might be competitors of his. This objection is met by the proposal of the Sub-Committee to appoint a competent engineer to inspect and report on work which is called in question. In the event of an adverse report, the costs of the inspection are to be borne by the defaulting contractor, whilst the employer is to pay if the report is favourable to the contractor.

It is considered in some quarters that the proposals aim at the elimination of slip-socket conduit, which, whatever its faults, has done a good deal to cheapen the cost of wiring and pave the way for screwed conduit, which is now regarded as an essential factor in really good work. Slip socket has, in fact, had its day, and few, if any, of the leading insurance companies look with favour upon it, although they possibly accept the risk in ordinary residential property.

There can be no doubt that one of the chief objects of the Electrical Contractors' Association, in formulating the proposals referred to, is to raise the general standard of wiring and to eliminate, if possible, the jerry wiring contractor, and these objects have our entire sympathy.

Expert Witnesses in America.

IT would seem that war is now being waged against the expert witness in the United States. According to a leaderette in the *Canadian Engineer* (May 22nd), a strong opposition to the present method of securing expert evidence in cases at law, and a growing feeling that expert witnesses should be designated by the Courts, led the American Institute of Consulting Engineers to hold a discussion on this subject a short time ago. The American proposal, apparently, is that in certain classes of cases which require expert testimony, such as the valuation of public utilities, conflicting claims of water-power companies, and the like, "time will be saved and cases will be better presented if studied from *ex parte* points of view before the action at law is begun. The appointment of engineer associates by the Court would probably be helpful in clearing up *conflicting and confusing testimony*." (The italics are ours.) With all respect to the president of the American Institute of Consulting Engineers who put forward this view when summing up the discussion, he seems to us to beg the whole question. What is the "conflicting and confusing testimony" which the engineer associate of the Court is to pass in review? Surely it must be the evidence of other experts. We make bold to say that every proposal to abolish the expert witness in technical cases which has ever been brought forward in this country has always had a fundamental flaw: no efficient substitute has been suggested. We recall the *dictum* of a distinguished Cambridge scientific professor who was asked whether he favoured compulsory Greek. "No," he replied, "I am against it." "But will you vote against it?" was the next question. "Yes," he replied, "I will, as soon as you satisfy me that you are going to put something as good in its place." Who is to replace the technical witness in a complicated electrical patent case? The plaintiff and the defendant must both put their arguments before the Court; and the arguments of counsel can only be founded upon the opinions of experts — opinions which those experts are prepared to uphold in the witness box, subject to the searching criticism of cross-examination. True, the inquiry may be long and tedious, but the results are generally satisfactory. Nor are our judges wholly incapable of dealing with a purely scientific issue when instructed by the skilled testimony of the expert. He who commends the present system is no mere *laudator temporis acti*. It is the growth of hundreds of years.

THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(*Abstracts of Papers discussed in Paris at the Joint Meeting of the* INSTITUTION OF ELECTRICAL ENGINEERS *and the* SOCIETE INTERNATIONALE DES ELECTRICIENS, *21st-24th May*, 1913.)

(*Continued from page* 927.)

The Electrification Schemes of the Chemin de Fer du Midi.

BY MONSIEUR JULLIAN.

THE problem of the electric haulage of trains presented itself for the first time to the Compagnie du Midi in 1902 at the time when the concession for the development of the line from Villefranche-Vernet Les-Bains to Bourg-Madame in the Department of the Western Pyrenees was offered by the State. The conditions for the building of the line differ very considerably from those inscribed in the scale of rates of the Compagnie du Midi. Advantages were conceded because the line to be constructed was of narrow gauge, with sharp curves, and because the gradients were 80 mm. per metre.

The question of the electrification again presented itself to the Compagnie du Midi in 1907, when the State proposed granting it the concession for lines which it wished to construct in the region of the Central Pyrenees, including gradients up to 40 mm. and curves of radius less than 300 metres. At the moment of signing the convention relating to these lines, the State entered upon new negotiations for the line from Pau to Hagetmau.

The Compagnie du Midi made a new proposal with a view to reconciling the interests of both sides, and two agreements were signed in 1907 and 1908.

When all the lines comprised in these two agreements are working, the Compagnie du Midi will have a system of 622 km. of electrified lines, of which 112 will be double track, that is to say:

Lines actually working	327	km.
Line under the agreement of July 4, 1908	227	,,
Lines crossing the Pyrenees	68	,,

The equipment of the lines actually working is in course of completion, and will be finished in the month of July next, throughout about half of this length.

Another electrification has been undertaken for other reasons; this is the line from Perpignan to Villefranche in the Eastern Pyrenees. In 1911 the company equipped this line electrically for a length of 24 km. in order to make some tests in view of the electrification of the Central Pyrenees line.

Owing to the fact that the outlay for these tests has already been incurred, and that the volume of mineral traffic on this line is constantly increasing, there is no doubt that electrification will be advantageous.

The Company has also had in view the extension of the electrification of other parts of its system by prolonging the lines which have just been referred to. The preliminary investigation into these electrification schemes has been made with favourable results. The electrification is justified by the extremely advantageous economic conditions under which it will be carried out. It is also justified by the particular features of the system. The lines to be constructed have steep gradients, which are one of the main factors leading to electrification. The lines now at work which are to be electrified run at the foot of the approaches of the Pyrenees, and often penetrate into the steep valleys. They have gradients of which the greater number lie between 15 and 32 mm. Except over the section in the neighbourhood of Pau the practicable speeds do not exceed 70 km. per hour, and the mean speed is rather nearer 60 km. per hour. These conditions are excellent for traction by electric motors. Finally, during a part of the year these lines have a heavy service of passenger trains, for the hauling of which electric traction will have some advantages.

The current used for the working lines is single-phase current at 16 periods and 12,000 volts. The frequency was fixed at 16 periods in order to secure the best working conditions for commutator motors of the series type. The engineers considered—and experience has justified them—that repulsion motors, although possessing a series characteristic, would not be suitable for working on so variable a load as required in this particular case of electric traction. The pressure on the working line was fixed at 12,000 volts for economic reasons.

It is intended to distribute energy by means of single-phase current at a pressure of 60,000 volts. The alternators at the station will generate current at 6,000 volts; the transformers will raise this pressure to 60,000 volts, and in the sub-stations the pressure will be stepped down to 12,000 volts for the supply of the overhead conductor. The distribution by means of simple alternating current is justified from the standpoint of economy.

In the experimental line from Villefranche to Vernet-les-Bains, six types of overhead equipment have been established: four of these belong to the simple catenary type, one to the double catenary, and one to the rigid type. The spans are 100 metres, 60 metres, or 50 metres, and the longer sections are provided with compensating arrangements.

It is clear from these tests that the simplest overhead equipment is the best, for almost all accidents are due to the faulty working or breaking of apparatus introduced to obtain a better compensation or a greater flexibility for the line, and the efficacy of such apparatus is in general very doubtful. To be precise, on the lines comprising fairly numerous curves of a radius lying between 350 and 800 metres, and worked over by trains at speeds between 75 and 80 km. per hour, but not exceeding 90 km. per hour, the choice should fall upon the simple uncompensated catenary type for spans of between 50 and 60 metres, with pull-offs on the curves to bring back the overhead conductor towards the centre of the track when necessary. The catenary cable should in this case invariably be anchored to the insulator at each bracket.

Poles made of reinforced concrete are too expensive, and owing to their weight too difficult to erect for existing lines. The "Midi" type of pole, composed of old rails fastened together, is very suitable for single-track lines, even if it has to support high-tension cables, provided that these cables are spaced at equal distances with reference to the axis of the pole. They cost very much less than other poles, are easy to erect, and do not sensibly obstruct the view.

For a double track with high-tension cables, the "Midi" pole made up of rails is not sufficiently strong, and lattice-poles must be used.

The overhead conductor is of red copper, 100 square millimetres in cross-section, of circular section, grooved for taking the suspension clamps.

The high-tension transmission comprises two lines, usually in parallel, each consisting of two aluminium cables, which have 131 square millimetres cross-section on the branches from Arreau to Pierrefitte, and 81 square millimetres cross-section on the other lines.

The insulators are of porcelain on the line from Lourdes to Pierrefitte, and of glass everywhere else. The high-tension insulators have been tested to 150,000 volts, and those for the overhead conductor at 4,500 volts.

Opposite each pole, to ensure that the rail shall not have a high potential with respect to the earth, the track rail and the pole are connected together and to earth. The rail joints are copper bonded.

On the first section, which is a single track, of which the length is 21 km., with a high-tension transmission line, the total cost amounted to 410,000 fr., including the equipment of the station sidings, except those at Lourdes, and all accessories. The equipment works out then at 19,500 fr. per kilometre.

On the sections from Tarbes to Lourdes, double track with high voltage transmission of which the length is 21 km., the cost of equipment reaches 450,000 fr. under the same conditions as those above. The equipment works out in this case at 21,500 fr. per kilometre.

The cost of equipment of large railway stations is not yet known; this will vary with each station in accordance with local conditions.

For the Central Pyrenees there will be two generating stations, at Soulom and Ejet. For the lines crossing the Pyrenees there will also be two generating stations, at Porte and Soussouéou. For the line between Perpignan and Villefranche the generating station will be at Fontpédrouse.

At the station at Soulom the work is in the most advanced state. The power continuously available amounts to a total of 10,300 h.p. This power, thanks to large reservoirs constructed at the head of the pipe lines, may reach 18,000 h.p. for periods sufficient to ensure the train service.

The four transmission lines leaving the station are protected by a large choking coil, an electrolytic lightning arrester, and a water-jet discharger. A Tirrill regulator is provided to keep the voltage constant in spite of the very considerable variations in load on the high-tension line.

It appears that the cost per horse-power installed will work out at about 500 fr.

The station at Eget has not yet been started. It will have an output of about 18,000 h.p.

The sub-stations will be five in number, and are placed at Montréjeau, Lannemezan, Tarbes, Lourdes, and Pau. Their normal output is 2,500 k.v.a.; they will have an overload capacity of 3,750 k.v.a. for one hour, and of 5,000 k.v.a. for one or two minutes.

Work on the generating stations at Porte and Soussouéou has not yet begun. At Porte power to the extent of 3,500 h.p. will be continuously available.

The work at the generating station at Fontpédrouse is as advanced as that at the station at Soulom; the station will be put to work towards the middle of June. The continuous power available at the shaft of the turbines is 2,600 h.p., and this power may be increased to 3,600 h.p. for an hour and a half by making use of the storage water available at the head works and in the reservoir.

The rolling stock consists of locomotives and motor-cars. The locomotives are especially intended for the hauling of long goods trains coming from or going to non-electrified sections. The motor-cars are provided exclusively for branch lines and for trains working on the electrified section only. Chiefly for the purpose of gaining the necessary information to decide on the type of locomotives and motor-car, the Compagnie du Midi in 1912 arranged for the tests already mentioned on the line from Perpignan to Villefranche.

In these tests locomotives were employed capable of starting a 400-ton train on an up-grade of 11 mm. per metre, and in addition of hauling a train of 100 tons at a speed of 60 km. per hour, and a train of 280 tons at a speed of 45 km. per hour over the hilly section from Ille to Villefranche, which has long and numerous gradients of 17 mm. per metre and some even of 21 mm. On a down-gradient these locomotives were able to deal, by electric braking alone, with the same loads at speeds

capable of being regulated by the driver between the up-grade speeds and one-half of those speeds. The electric braking can be obtained by returning the energy given out by the motors, either to the transmission (regenerative braking), or else to resistances.

The motor-cars can haul over the above gradients a train of 100 tons, motor-car included, at a speed of 65 km. per hour, and on the down grade electric braking occurs under the conditions indicated above, but without always returning current to the line.

Three of the locomotives tested satisfied the conditions imposed. These locomotives were constructed by the Ateliers de Constructions Electriques du Nord et de l'Est, by the Compagnie française Thomson-Houston, and by the Compagnie française Westinghouse. The motor-car constructed by this latter firm also satisfied the conditions. These tests are not yet concluded.

In the locomotive made by the "Ateliers du Nord et de l'Est" the torque of the motor is transmitted to the wheel by a pinion keyed to the motor shaft and a spur wheel driving the axle through a spring coupling.

This arrangement, demanding the use of at least one motor per axle, allows the power to be divided up among several motors, which simplifies their construction and also the design of the locomotive. But it has the drawback of lowering the centre of gravity of the locomotive, which results in punishing the track. The test locomotive weighs 86 tons, and current is taken from the line by two pantographs. Control is effected by means of an induction regulator, which allows of contactors being dispensed with. The working of this regulator gave satisfaction during the tests.

The motors are of the Latour series-repulsion type. They are designed to start as repulsion motors and to change to series motors automatically as soon as the speed reaches 25 km. per hour, which corresponds with synchronism. Each motor is able to develop 400 h.p. for 6 hours, and 500 h.p. for 1 hour.

During the repulsion working the stators of the three motors are connected in parallel, so that each rotor cannot take up a speed appreciably different from that of the other two. This provides an electric coupling which has given good results during the tests. Forced air ventilation of the motors is used.

For the regenerative braking the motors working as generators employ for their excitation current lagging 90 deg. behind the supply current. This current is furnished by a winding on the stator of the ventilating fan motors. After some initial trouble the regenerative working has given complete satisfaction.

On test this locomotive has hauled a train of 100 tons on an up-grade of 17 mm. at a speed of 60 km. per hour, taking from the station 860 kw.; a train of 280 tons on the same incline at a speed of 41 km. per hour, taking from the station 1,150 kw. The electric braking requirements on descending grades have been fulfilled, and the power returned to the line has often reached 350 kw. With regenerative braking the power factor is very nearly unity. The current given out by the motor may, in fact, actually be in phase with the pressure, or even leading in phase.

The Compagnie du Midi has ordered eight locomotives of this type, with the power increased to 1,500 h.p. continuously, or 1,800 h.p. for 1 hour, with a max. speed of 90 km. per hour. The repulsion working at starting is to be suppressed, and the electric coupling of the axles to be retained at all speeds. The locomotive to weigh 90 tons.

The locomotive made by the Compagnie française Thomson-Houston is equipped with two motors only, and the use of connecting rods has been unavoidable. The locomotive weighs 89 tons. The electric control is effected by varying the voltage supplied to the motors, requiring the use of contactors connected to tappings on the secondary of the main transformers.

The motors are of the series-repulsion type, and the connections are automatically made for repulsion working for speeds below 25 km. per hour. The working of this arrangement has given trouble. The makers are engaged on a new design.

The Westinghouse locomotive is equipped with two motors, requiring the use of idle shafts and connecting rods. The trial locomotive weighs 82 tons. The electrical control is effected by varying the voltage supplied to the motors by means of contactors. The motors are of the compensated series type and work in series all the time; they have forced ventilation, and can develop 600 h.p. for 6 hours, and 700 h.p. for 1 hour. The motors are not designed for repulsion working.

When a high-tension power transmission line and a telephone or telegraph line happen to run close together for a considerable distance, the former sets up induced electromotive forces in the latter, resulting in disturbances in the receivers. Disagreeable, if not dangerous, results may follow to workmen and to the public. These phenomena are produced with special intensity if the two lines are alongside railway track, and if alternating current is returned by the running rails. In such a case, the current instead of returning wholly by the rails returns in greater or less proportio nthrough the earth, thus affecting the telegraph apparatus, which works with an earth circuit.

Up to the present the precautions taken to avoid these disturbances are neither completely efficacious nor practically realisable, owing to their cost. This applies to the replacement of the lines affected, and the use of telegraph circuits without earth connections.

It was considered better to find a solution of the problem by the use of apparatus capable of neutralising the effects of the disturbing currents. Among those which have been considered, that of M. Girousse has proved successful in the protection of Morse apparatus, as has been demonstrated in official tests. The company is about to apply these protectors in the first place to the railway station apparatus on the line from Perpignan to Villefranche, and will bring them into general use, if required, on the whole of the electrified section. The Post and Telegraph Administration has decided to install this apparatus in such offices as are affected by the traction current.

In order to ensure satisfactory working of the telephone, the Administration is about to replace ordinary insulators by others of greater insulation resistance, to transpose the two lines every 300 or 400 metres, and to insert transformers between the lines and the receiving apparatus. This last arrangement, the object of which is to save users from dangerous or perhaps only disagreeable shocks, has the drawback of weakening the sound of the voice; it is the same fault which hitherto has prevented the use of protectors for telephonic apparatus. Nevertheless, experiments with these protectors have not been given up.

The Compagnie du Midi will probably have to pay the cost of all this work. That will not prevent it from trying all suitable means for rendering the traction current as harmless as possible to telegraph and telephone lines. For this purpose the company contemplates the addition to the alternators and to the motors of arrangements for damping the high harmonics, to which the disturbing phenomena should be attributed to a large extent.

From the foregoing account it is clear that the electrification of a large railway system is to be undertaken by the Compagnie du Midi, under conditions as advantageous as possible.

Petrol-Electric Motor-Vehicles.

By MONSIEUR J. B. G. DAMOISEAU.

Of the various heat engines capable of application to automobiles running on rails, the internal-combustion engine using liquid fuel —petrol or benzol—is the only practical type. Continuous current is likewise universally employed.

The design adopted for motor-vehicles using internal-combustion engines is necessitated by the limitations of these engines. Thus, as internal-combustion engines are unable to start under load, means must be provided for starting them light. Moreover, such engines give a practically constant torque, and to be economical should run at a speed below that corresponding with maximum power so as to prevent the engine being pulled up; but as they must operate somewhere near that critical speed, it follows that it is essential to introduce gearing between the engine and the axles so that the speed of the car can be varied whilst that of the engine remains uniform.

As the internal-combustion engine can work either at constant or variable power (by regulating the admission of the fuel), and the power required for traction is also variable, two distinct methods may be considered :—

(*a*) An arrangement comprising a means of storing energy and for dealing with the fluctuations in the demand for energy whilst the engine generates constant output. This method has the advantage of allowing the energy to be stored which is produced when the car runs down gradients, and whilst braking.

(*b*) An arrangement in which energy is not stored, and in which the engine supplies the power necessary for driving the vehicle.

There are at the present time automobiles with internal-combustion engines and mechanical, electrical, and mixed drive; but those with the mixed drive are the only ones in which accumulators are utilised. The present paper deals with motor-cars with internal-combustion engines and with electrical or mixed drive.

In 1904-5 the Société Anonyme de Locomotion Electrique, owners in France of the Heilmann patents, built a petrol-electric vehicle to demonstrate its practical value. At about the same period trials with motor-vehicles were being carried out in England by the North-Eastern Railway Co.; the petrol engine was constructed by the Wolseley Tool and Motor-Car Co., and the electrical equipment was supplied by the British Westinghouse Electric and Manufacturing Co. These two cars were only test cars to prove the practical value of this form of traction.

The first exploitation of petrol-electric motor-vehicles dates back to the years 1905-6, and was undertaken by the Hungarian Arad Osanad Railway. This railway system has normal gauge and a length of 400 km. It was worked at first, as far as the passenger traffic was concerned, with 36 petrol-electric cars of two types. Those destined for slow trains had each a petrol engine of 30 H.P., and those for fast trains a 70-H.P. engine. The petrol engines and the generators of all these cars were supplied by the Société de Dion-Bouton.

As traffic increased in consequence of the introduction of this kind of traction, the railway company was induced, so that trailers could be added, to increase the equipment from 30 H.P. to 40 H.P. It was found essential to increase the power still more. A Hungarian firm, a branch of the Société Westinghouse du Havre, was asked to undertake this transformation, which is still being carried out. The cars at present in use are of 40 and 70 H.P. (Dion-Bouton) and 60 and 90 H.P. (Westinghouse). This is at present the most important application of this kind of traction in Europe.

The Dion-Bouton cars have each a petrol engine with four vertical cylinders driving through a flexible coupling a continuous-current compound-wound generator running at 500 volts. This group supplies electrical energy to two electric motors which drive the two axles of the car. A controller is fitted in the driver's cabin, with one handle for operating the car in either direction, and

connected for series-parallel working, the speed of the car being controlled in that way. This controller is fitted with four notches for forward running, and only one for reverse. The air required for the brake is supplied by an air compressor worked electrically and provided with an automatic pressure regulator. When the current is interrupted by means of the controller the engine runs at the reduced speed of 300 R.P.M. When the controller is brought into operation, the current supplied by the generator has the effect of opening gradually the regulating valve, consequently of increasing the speed and the power of the engine. When the speed of the engine is sufficiently high, the car starts, and its speed can be regulated by the controller.

The two four-pole motors are of the series type. The field coils of each motor are connected two in series, and each pair can be connected in series or parallel. In order to pass from one notch to another, whether for increasing or decreasing the speed of the car, the driver first operates the control valve so as to reduce the speed of the petrol engine, then places the controller in the position required for the desired speed, and finally brings back the control valve to its first position corresponding with normal speed. This method of working is to prevent the current being broken at the controller. The petrol engines have four cylinders, and run at 1,000 R.P.M.

The cars are heated by the water which circulates in the cylinder jackets, and are lighted by means of acetylene. The 40-H.P. cars provide seating accommodation for 42 passengers, and weigh 13 tons; the 70-H.P. cars seat 39 passengers, and weigh 16·5 tons. Each of these motor-cars is capable of hauling two trailers with seating accommodation for 96 passengers, and of a total weight of 12·6 tons.

The motor vehicles on the Westinghouse system are of two types. The first has a 60-H.P. petrol engine with four cylinders, and the other has a 90-H.P. engine with six cylinders. The engine is connected through a flexible coupling to a continuous-current generator with shunt excitation. The pressure of the generator can be varied between 300 and 550 volts by altering its excitation and the speed of the engine. The generator supplies current to the two electric motors driving the axles of the car. The electrical plant is always placed crosswise in the driver's cabin.

Each driver's cabin contains a special controller with two handles for connecting the motors in series or parallel, adjusting the excitation of the generator, varying the speed of the petrol engine and of the car in either direction; the air brake is generally fed by an electrically-operated compressor having an automatic pressure regulator.

The driver starts the car and regulates the speed by means of the controller, which connects the motors in series or parallel, and also varies the excitation of the generator. To vary the amount of air admitted to the carburetter, and thus the speed of the engine, the driver turns the top portion of the controller handle, which, by means of a connecting wire, acts on the governor of the engine. This control is, therefore, independent of the field circuit of the generator and the connections of the motors. If the stud in the handle is released the engine slows down, and the car stops. This contrivance operates, therefore, in the case of any failure on the part of the driver. The Westinghouse cars are able to haul one or two trailers.

The Prussian State Railway management in 1907 adopted some petrol-electric cars made by the Allgemeine Elektricitäts Gelleschaft and the Bergmann Elektricitäts-Unternehmungen Aktien-Gesellschaft.

Each of the cars equipped by Messrs. Bergmann comprises an electric generating set, spring-supported, which rests directly on the two axles of one of the two bogies of the car, the other bogie carrying two electric motors, to which current is supplied by the generator. This arrangement facilitates the rapid replacing of the set, and avoids the transmission of the vibrations due to the engine to the body of the car. The body of the car is entirely distinct from the generating plant, the engine being covered with a removable hood. The benzol engine has six cylinders, and develops about 100 H.P. at 700 R.P.M. A centrifugal governor controls the admission of the gas, and is connected to the controller handle, so that the speed of the engine is reduced automatically to one-third when the engine runs without a load.

The engine is started by means of compressed air obtained from the reservoir for the air brake, the air compressor being driven by a benzol engine. The engine weighs 2,500 kilograms. The liquid fuel is stored in a reservoir, being covered with an inert gas under pressure, either nitrogen or carbonic acid gas being used; the latter are stored in a gas cylinder. The continuous-current generator, the pressure of which is varied by altering its excitation, is direct coupled to the engine, and is fitted with commutating poles and a compensating winding. It can develop continuously 66 KW. at 300 volts and 700 R.P.M. As the speed of the car is only controlled by varying the excitation of the generator, it is necessary to use accumulators to maintain a steady pressure for the electric lighting of the car, the electric alarm bell, the field windings of the motors, and for exciting the main automatic switch. By means of a special arrangement, this generator with its variable pressure can supply current to the auxiliary circuit for charging the battery.

Each of the two electric motors, which are of the series type and are fitted with commutating poles, can develop 85 H.P. for one hour. The controller is fitted with a push button, so that should the driver remove his hand from the controlling handle when the latter is on one of the forward notches, the whole of the current is cut off and the compressed-air brake is immediately brought into action.

This car, with accommodation for 100 passengers, weighs 47 tons, and reaches on a level a speed of 70 km. per hour.

The motor-vehicles supplied by the A.E.G. Co. for the Prussian State Railways are arranged to a considerable extent on the same plan as those of the Bergmann Co. The electric lighting of the car is supplied from the exciter and the battery, which are connected in parallel when the speed of the electric generator is 700 R.P.M. When the speed is below this, the exciter is automatically cut out of circuit and the lighting is obtained from the battery. The car provides accommodation for 95 passengers, weighs 55 tons, and has a speed on the level of 65 km. per hour.

The same company has built, for branch lines, another type of petrol-electric car of 55 H.P., which was recently placed in service on the East German railway system at Königsberg, East Prussia.

In the motor-vehicles of the General Electric Co., U.S A., the two electric motors are lodged on the front bogie beneath the driver's cabin. The main set consists of a gasolene engine driving at one side an electric generator and at the other an air compressor. The auxiliary set comprises a petrol engine driving an electric generator and an air compressor.

The main engine has eight cylinders, and runs at 550 R.P.M. The generator has eight poles as well as commutating poles, and supplies 100-KW. continuous-current at 600 volts. The voltage of the generator varies from 200 to 800 volts, according to the power required for traction.

The two electric motors, which are fitted with commutating poles, are designed for a pressure of 600 volts and can each develop 100 H.P. for one hour.

The controller connects the motors in series and parallel and varies the excitation of the main generator.

The cars are constructed entirely of metal, having seating accommodation for 60 to 100 passengers, and weigh from 40 to 50 tons. They are capable of developing a draw-bar pull of about 5,500 kilograms, and a speed on the level of about 90 km. per hour.

The Great Western Railway Co. of England is at present experimenting with a motor-vehicle having only two axles, and the electric equipment has been supplied by the British Thomson-Houston Co.

The petrol engine of 40 H.P. drives a dynamo which supplies current to two electric motors, each of which transmits power to one axle. This car weighs 14 tons, and has seating accommodation for 44 passengers.

The petrol-electric motor-vehicles at present undergoing trials on the Swedish State Railways are the first to be equipped with Diesel engines for use on railways, to reduce the cost of fuel. Each motor-vehicle has a Diesel engine of 75 H.P. at 700 revs. per minute, coupled to a 50-KW. continuous-current generator feeding the two electric motors, each of 30 H.P. The Diesel engine used has six vertical cylinders, water-cooled, and a supplementary cylinder for supplying the compressed air necessary for starting the engine and for injecting the petrol for starting. The fuel consumption is said to be 225 grammes of oil per horse-power-hour at the full load of 75 H.P.

The generator gives a variable pressure from zero to a maximum of 440 volts according to the speed of the engine. It has commutating poles and is connected to the engine by means of a flexible coupling.

A battery of 23 cells and of 200 ampere-hours capacity is automatically connected with the generator when running without load, *i.e.*, when the car is at rest or running down an incline. This provides the lighting of the car, besides supplying the auxiliary apparatus used in working the car.

The speed of the engine is regulated by a small electric motor operated from the controller. No starting resistances are employed. When the normal speed of the engine is reached, the regulation of speed is effected automatically, the design of the generator and of the electric motors being such that the power taken from the petrol engine is remarkably constant and cannot exceed the maximum power that the engine can give.

The arrangement to ensure the greatest measure of safety in working is as follows, one attendant only being required: On the roof of the car and on each side wooden bars have been fixed for keeping a spring mechanism in position. If the car passes beyond a signal which is at danger, one of the bars strikes an arm fixed to the signal, opens a switch in the motor circuit, and puts the air brake in action, thus stopping the train.

These motor-vehicles seat 39 passengers, weigh 26 tons and are built for a maximum speed of 60 km. per hour. The electric equipment was supplied by the Allmänna Svenska Elektriska Aktiebolaget.

The automobiles on the Pieper system are of the mixed-transmission type, with energy storage and regeneration. In this system the internal-combustion engine drives the axles directly by means of a cardan shaft and bevel gear. A shunt-dynamo fixed on the engine shaft is connected to a battery of accumulators.

When the power of the engine is insufficient, the battery automatically supplies energy to the dynamo, which then operates as a motor. When the power given by the engine is in excess of that required for traction, or when the kinetic energy of the car can be recuperated, *i.e.*, when the car is slowing down or running down a gradient, the dynamo works automatically as a generator and charges the battery.

The admission of the gas to the engine is controlled by an automatic regulator consisting of a differential solenoid.

The driver starts the engine by sending the current from the battery into the dynamo, which is excited to the maximum. The engine having been started, the driver admits current from the battery gradually into the electromagnetic clutch. This starts the car smoothly, and its speed is afterwards increased by gradually diminishing the excitation of the dynamo. Its control is afterwards effected automatically.

When the car reaches a gradient, should the resisting torque on

the wheels become greater than the turning moment of the engine, the speed of the latter diminishes, the voltage of the dynamo falls and becomes less than that of the battery. The battery then discharging into the dynamo produces a torque which assists that of the engine until it balances the resisting torque of the car. The assisting couple produced by the motor is, moreover, a maximum, since the admission of the gas, which is governed by the discharge current, is likewise at a maximum.

Similarly, when the car arrives on a gradient, if the resisting couple is less than the turning moment of the engine, the speed of the latter tends to increase, and the voltage of the dynamo rises so that the dynamo begins to charge the battery. This charging current passing through the regulator results in the rate of admission of the gas being reduced to the minimum and the torque of the engine becomes zero. For each section of the route, equilibrium is obtained between the three torques, viz., the torque of the car, the torque of the engine, and the opposing or motoring torque of the dynamo.

In order to slow down or accelerate at will the speed of the car, it is sufficient to upset this equilibrium. To slow down, the resisting torque must be increased; this is done by the driver increasing the excitation of the dynamo, which then begins to charge the battery. This charging current diminishes the rate of admission of the gas and consequently the driving torque. The kinetic energy stored in the car is thus restored to the battery. For accelerating purposes the driving torque must be increased, *i.e.*, the excitation must be diminished. When the car is at rest, the engine clutch is disengaged. The engine may then be either stopped or changed to low speed in order to charge the battery.

This description shows that the internal-combustion engine owing to its constant connection with the axles of the car, and owing to the fact of its being automatically governed, works with variable cut-off. This type of motor-vehicle, which requires accumulators, has also the advantage of storing energy when the car is slowing down or running down gradients. In the motor-vehicles in operation on the Pieper system in France, by the Compagnie des Chemins de Fer de Grande Banlieue, from Saint-Germain to Poissy, the generating set with its two clutches is suspended on springs by two longitudinal girders from the frame of the car, between the two bogies, below the luggage compartment. This set drives the extreme axle of each bogie through a cardan shaft and bevel gear. The engine has four cylinders, and uses benzol as fuel. The car has seating accommodation for 33 passengers and standing room for 16. It weighs 21·7 tons, and can haul two 10-ton trailers.

A motor-vehicle on the Thomas petrol-electric system, with mixed transmission, is in service on the Central South African Railway.* This car has a petrol engine, epicyclic gear and two dynamos. The whole works on M. Gasnier's electromechanical method of varying the speed. The electric generating set is placed in the centre of the car, and drives through a cardan shaft and gear the extreme axle of each of the two bogies.

The dynamos are series wound, and are permanently connected in series. The car is started and its speed controlled by varying the excitation of the two dynamos. The engine develops 120 H.P. at 670 R.P.M.

The car has seating accommodation for 42 passengers, and weighs 21·5 tons; when running without a trailer a speed of 80 km. per hour was reached on the level, and with a 16-ton trailer a speed of 70 km. per hour.

The advantages of independent motor-vehicles, no matter of what type, depend essentially on the possibility of forming trains of less weight, and consequently of employing a greater number of trains than is the case with steam locomotives. This increase in the number and frequency of the trains should result, in general, in an increase in traffic, and consequently in the revenue, which would cover—supposing that the working expenses are not too high—the initial capital outlay of certain secondary or local lines which, if operated with steam locomotives, could not give such good results.

This use of independent motor-vehicles could even be extended to certain main lines of important railway systems, and would allow an increase in the actual overall speed of long-distance trains, by doing away with stops at the less important stations, such stations being served with independent motor-trains. This method of working, viz., separating the general traffic from the local traffic, would make it possible to do justice to the requirements of these two kinds of traffic, which requirements are at present so conflicting; and in that way it would bring about an increase in the speed and frequency of communication, both of which are so much insisted upon by the travelling public.

The introduction of petrol-electric cars has numerous advantages.

By using internal-combustion engines the car is always ready to start, and only a short time is required to take in fuel, &c., for long journeys. The start is as rapid as in the case of all vehicles adapted for electric traction, consequently the net speed is increased. One man only is required to drive the car, which is easy and safe to work. The driver can concentrate all his attention on the speed of the car, and on the track and the signals. The absence of smoke, and the fact that he stands at the front of the car, facilitate his observation of signals, &c.

The petrol-electric cars are very flexible as regards their operation, owing to the system of control employed. If the stops are of long duration the engine can be shut down and any waste of fuel thus avoided. The maintenance of petrol-electric cars can be attended to without interrupting the service. Repairs are rarely necessary, and the removal from service for this purpose is, consequently, of short duration.

The use of two drivers' cabins dispenses with the necessity of turning the car at the terminus. The reduced weight of the petrol-electric cars and their smooth running reduce the wear of the rails to a minimum.

The cars can be coupled together by very simple contrivances to form trains, which can be operated from one of the driver's cabins, as is done in the case of multiple-unit electric traction.

Finally, the petrol-electric car, having no permanent mechanical connection between the engine and the axles, may be placed between any two carriages of a train hauled by a steam locomotive, and may be used as an ordinary carriage. At any point *en route* the petrol-electric car may then be removed and continue its journey in any desired direction by its own means of propulsion. In this way several distinct trains may be combined as one train, each section branching off as required.

The principal disadvantage of the petrol-electric car consists in the danger of fire, consequent on the use of a highly inflammable liquid fuel. However, this danger can be completely overcome.

The component parts are very simple, and the most complicated part, the internal-combustion engine, has been so extensively adopted that this point need not be discussed.

From a comparison of various systems it follows that the simplicity of the electric transmission and its flexibility justify its almost exclusive adoption.

The liquid fuels used for motor-vehicles are: gasoline or petrol (density, 0·680—0·720) and benzol (density, 0·885). In countries where there are no supplies of petrol, the present practice is to use benzol, which is a natural product distilled from coal-tar. These two fuels have practically the same calorific value, produce almost the same power from the engine, and can be used alternatively without any modification of the plant. When using benzol it is necessary to start with petrol because benzol requires a certain amount of pre-heating.

In France the price of benzol is about 0·25 franc per litre, whilst petrol, owing to the duty, costs 0·35 franc.

The cost of fuel could be very much reduced by using heavy oils derived from the distillation of petroleum or tar, the prices of which are at present relatively low. The price of the generating set is higher, both as regards the engine and the generator, on account of the lower speed.

The price of a petrol-electric car varies from 40,000 to 150,000 francs. A 90-H.P. car weighing 20 tons and having seating accommodation for 40 passengers costs about 50,000 francs. The 120-H.P. car of the type used on the Prussian State Railways, which weighs 50 tons and provides accommodation for 100 passengers, costs about 90,000 francs when fitted up for third and fourth-class traffic.

The motor-vehicle of the General Electric Co., weighing from 40 to 50 tons, with accommodation for from 60 to 100 passengers, costs from 100,000 to 150,000 francs according to the furnishing of the interior.

The consumption of fuel depends on many factors, and varies according to the traffic of the line on which it is operated. The consumption of fuel per ton-kilometre varies in practice between 15 and 30 grammes according to the profile of the line and the condition of the track.

Assuming that the fuel used is benzol, as is the case in France, the cost of running cars on the petrol-electric system is as follows, the figures being given per ton-kilometre:—

Fuel (benzol)	0·0042 fr.	to 0·0084 fr.
Lubrication	0·0005 ,,	,, 0·0010 ,,
Repairs and maintenance	0·0015 ,,	,, 0·0040 ,,
Total running expenses ...	0·0062 fr.	to 0·0134 fr.

The driver's wages may be taken as 0·0040 fr. per ton-kilometre.

Although the time that such cars have been in use is too short to allow the "wear and tear" and depreciation to be determined from experience, it appears that if we take 10 per cent. per annum of the value of the total equipment, including the car itself, this estimate is, if anything, rather too high. As an annual mileage of 50,000 km. may be expected per car, this means that "amortisation" represents about 0·005 fr. per ton-kilometre.

If interest on the capital invested is taken as 5 per cent., this represents 0·0025 fr. per ton-kilometre. Thus the total cost of running, if wages, "amortisation," and interest are taken into account, is 0·0177 to 0·0249 fr. per ton-kilometre.

Lines which can be worked by petrol-electric cars must have a relatively small traffic, because the working of a line by petrol-electric cars can only be economical with light trains; and relatively constant traffic, because the power of these cars does not allow heavy trains to be run. It is necessary for the goods trains to be hauled by steam locomotives.

The four types of independent motor-vehicles are at present steam, accumulator, petrol with mechanical tranmission, and petrol-electric. Accumulator cars have, however, been abandoned, and as the petrol engine with mechanical transmission has not been found sufficiently flexible, there remain, therefore, at present only the steam motor-car and the petrol-electric vehicle. The characteristics enumerated for petrol-electric cars emphasise the shortcomings of the steam motor-car, and the conclusion may, therefore, be drawn that if the use of independent motor-vehicles continues to develop—and there is no reason why it should not—then petrol-electric motor-vehicles will preponderate.

(*To be continued.*)

* This system was fully described in the ELECTRICAL REVIEW, May 5th and June 23rd, 1911, and September 27th, 1912.

NOTES FROM INDIA.

[FROM OUR OWN CORRESPONDENT.]

Dacca.—The new company, called the Dacca Electric Supply Co., has begun to do productive work, and promises of success are assured. The managing agents in Calcutta, Messrs. Octavius Steele & Co., know how to make a sound bargain for their shareholders. They got the Provincial Government to guarantee a minimum consumption per annum, which will at least pay interest and standing charges, thus ensuring that all sales of current beyond this figure go towards net profit. The old Dacca Electric Lighting Trust, which has done good service for 10 years back, has been absorbed by the new company; as it had established a fairly large connection, this should automatically go over to the new company and become a valuable asset. In spite, therefore, of the degradation of Dacca from being the capital of a province to its present position as a provincial town, there is every prospect that the efforts of the promoters of this enterprising scheme will be rewarded by handsome dividends later on. Big developments are anticipated, and the time will perhaps come when Dacca may be justly called the Oxford of India.

Madras.—The Madras Electric Supply Co. has, for the second time since its opening, given notice that in certain districts its mains are fully loaded, and that the present machinery in its power house is not, until further extensions are carried out, able to cope with any more load. This points to wonderful and unexpected development, which should be pleasant news for the shareholders. Power users in and about Madras have been quick to realise the benefits of cheap power. The Madras Tramways Co., having scrapped or sold their old steam generating plant, now buy current in bulk from the supply company, with the result that even their shareholders have been experiencing profitable returns in the shape of a good dividend.

Electric street lighting has made great strides in Madras. A very few years ago it was usual to carry about with one after dark a Hink's or similar lantern as the street lighting was so bad; now some of the principal thoroughfares are well lit, and bear favourable comparison with those of any other city in India.

Lahore.—The Electric Supply Co. is daily adding new consumers to its mains and promises to show good financial results in the near future. Local power users, such as mill and factory owners, are beginning to see that there are many advantages to be gained by using electric power, and spurred on by the frequent visits of contractors' representatives, they are slowly but surely coming round to the inevitable opinion that the substitution of electric drive for expensive steam is good economy. With steam coal costing 24 Rs. a ton in Lahore this is not to be wondered at—by the way, good steam coal costs 5 Rs. per ton at the pit's mouth in Bengal, the balance is railway freight.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Accidents in Electric Lifts.

As active workers for many years in the field of invention for the above object, we are interested in the recent discussion on safety locks, and the more so as our work and published views have been referred to more than once.

Mr. W. J. F. Cooper leads off in his first letter with an attack on the character of all locks of a date prior to "a few weeks back," basing it on the admittedly hypothetical danger that the interlocking of the latch may never take place.

He supports his argument by pointing out that the motive power of most interlocks is gravity, or the recoil of a spring, which powers are alleged to be especially likely to succumb to rust and dirt.

He then claims to have seen a lock which avoids this risk and "overcomes all defects," &c. But he does not describe the mechanism of the lock, or give more than a hint of the methods adopted, so we are left to surmise.

By the context, however, we are bound to suppose that gravity and springs are barred; the motion of the cage is specifically barred; and turning to Mr. Cooper's second letter we find the only positive clue in the words—"No gate can be opened till the current has been cut off from the controller." Conversely we may therefore assume that the locking operation is effected by switching current on to the controller, and presumably through the intermediary of one or more solenoids or magnets.

In any case the duty of locking and unlocking is shifted to the controller, and, if so, why find fault with gravity and springs? Does Mr. Cooper know of any lift controller worked by switches which does not depend on gravity or springs for its motion in one direction?

But leaving the controller and coming to the solenoid which actually does the locking, is it seriously contended that the magical letters S O L E N O I D provide unlimited power to overcome dirt and rust.

Those who know most about them know that their power is limited as definitely as that of a spring or of a falling weight, by the conditions prescribed by the designer.

The secret of success in all three cases is the provision of an ample margin of power to overcome all reasonably contingent obstacles.

Mr. Carroll reminds us that springs break. Just so, and solenoids go to earth or short circuit and burn out—or get overheated and jib—or fail to get current at all through their switches.

As to the liability of a spring to break (its only tangible defect, in our recent work, not only in locks but in other directions) we have devised modifications enabling a spring fractured into several fragments to act as effectively as when intact.

So far as Mr. Cooper's description carries us, it is therefore difficult to see how the lock he writes of advances matters in the direction of security against the only danger he describes, that of the interlock failing to act. Solenoids will fail as often as springs from dirt and neglect, and will also suffer from troubles peculiar to themselves.

But Mr. Cooper's find does apparently prevent unfair interference with the lift when passing a floor by persons who have not called it. That, however, is not a question of safety, but purely one of removing a nuisance.

We hold no brief for the force of gravity or for springs—there is no need; the former has been working quite satisfactorily for much longer than "a few weeks," and the latter have been doing good service at least since the days of Archimedes.

Our object so far is merely to clear away some confusion of thought and false reasoning, as will appear below.

Mr. Cooper says he has "had every-day experience of lifts for many years;" later he quotes a specification of ours, dated 1905 (*eight years ago*), and says it "fairly represents modern practice." Is that quite fair? Or is it a compliment?

The facts are that in 15 years we have improved our lock 17 times, we have issued 18 distinct patterns, and the 1905 pattern referred to is known as our No. 9. In 1905, however, it stood for a long step in advance of all predecessors, and therefore appears in the Patent Office files.

Mr. Cooper states that the lock which he discovered "a few weeks back" produces the following results:—

"The gates must be electrically and mechanically locked (not merely latched) before any movement of the cage can take place, and the locking action depends in no way upon the motion of the cage. Also the gate cannot be opened while the cage is passing the floor, but only when the control current has been cut off by the operator or the control gear."

He also refers to it as "unique," "the only one," and as the "one type of lock" which solves the problems, and he, therefore, may be interested in the following additional information:—

One of our nine patterns introduced since 1905 accords precisely with the above quoted specification, and it was designed very much farther back than "a few weeks."

We have been acquainted for about two years past with two different systems in use in Continental cities, achieving the same results with more or less success. We have reason to believe that such apparatus is obtainable in this country from three separate sources.

There is, however, another point arising out of Mr. Cooper's letter. Unlocking the latch at the proper time is often more important than detecting the correct moment for locking it.

It is to be regretted that we are not told exactly how it is done. We know that it follows the cutting off of current to or from the controller, and may assume that only the latch on the floor for which the cage is destined will be released.

But suppose that for any one of a dozen possible reasons, current is cut off when the cage is between floors above or below its destination—will that predestined latch be released all the same?

It may be replied, "No, the cage must be opposite the floor." But what is meant by "opposite."

This question is not frivolous. Much play has been made by two writers on the fact that most interlocks act only after the cage leaves the floor. Whatever value there is in this point, exists equally when considering the question of unlocking.

Nothing could be more simple than to confine the unlocked zone to a space, say, $\frac{1}{2}$ in. above and $\frac{1}{2}$ in. below the floor. But even that done, with high-speed switch-controlled lifts, with a new boy in the cage missing the floor every time by 6 in., the apparatus would soon be scrapped.

But there is another condition to be considered. Lifts will overrun occasionally beyond normal limits, and the various safeties and limit switches need time and space in which to act, and the cage may be from 2 ft. to 3 ft. beyond the top or bottom floor when finally stopped. Obviously, the passengers would be alarmed, and if they could not, then instantly escape through an *unlocked gate*, the financial results to the owners might be emphasised.

Experience has, therefore, practically determined that an unlocked zone measuring about 2 ft. 6 in. above and 2 ft. 6 in. below the floors should be provided.

When that phase of the problem is faced, the designer is apt to find himself once more in close company with the despised inclined plane, spring and force of gravity, or some of them.

As a matter of fact, we never heard of any accident arising from the provision of an unlocked zone extending 2 ft. 6 in. in either direction, and the Duc de Louge's death was in no way connected with that feature.

Most of Mr. Carroll's points have been touched on above, but his ideal lock is worth summarising.

It is to be automatic, not to work by gravity, springs, or the motion of the cage, and it is to act before current is switched on, so that solenoids are ruled out. As an "ideal" we lift our hats to it, but fear it will remain in that stage for some time yet—though little is really impossible in "electrics" if purchasers will pay for it.

Mr. Carroll's last six lines read rather like a misconceived paraphrase of something we have often written. Our letter is already too long to correct this in detail, so we merely say that Mr. Carroll's words do not represent our views. It may be that we were not in his mind at all.

Smith, Major & Stevens, Ltd.

Northampton, *June 2nd*, 1913.

I have been extremely interested in the recent correspondence relative to the above, and have been expecting to find the matter taken up by some of our lift makers.

From an architect's point of view, the statements made by Mr. W. J. F. Cooper, supported by Mr. Carroll, are somewhat startling, and if correct, it behoves architects to hesitate before accepting the advice of lift experts when specifying. Surely the subject matter of your correspondents is not too trivial to be allowed to pass unchallenged by any of them?

One can only conclude that the letter has passed unnoticed, or that the alleged inefficiency of safety locking and lift control is a fact.

Generally speaking, it is not within an architect's power to appreciate the technical details and working of these points, and he has to place reliance on lift makers.

It would be of interest to hear other opinions on this vital matter.

G. W. Newman.

Brighton, Sussex.
June 9th, 1913.

Electric Lighting Fittings.

Your correspondent, "R. E.," prefaces his letter with matter not likely to interest your readers, so, personalities aside, let us proceed.

No matter how efficient the form of reflector, there is no getting away from the fact that with indirect fittings the light is first projected from the lamp to the reflector, thence to the ceiling and back to the working plane, covering part of the distance for the third time, so that we get—

1. Loss from lamp to fitting.
2. Loss on first reflection.
3. Loss from reflector to ceiling.
4. Loss on second reflection.
5. Loss from ceiling to working plane.

I would again repeat that, in these days of competition, we cannot afford to entirely ignore efficiency. Surely the most efficient method of lighting is direct lighting, and if we can conceal our source of light and, at the same time, produce direct lighting, this must be the most common-sense method; to my mind it fulfils all the physiological points raised in "R. E.'s" letter. Is it not possible to fit the efficient reflector he speaks of, so as to reflect the light directly where it is required, and without the intervention of the ceiling, which, by the way, is not primarily designed for reflecting purposes? It should be an easy matter to interpose a small translucent or even opaque screen to protect the eye from the glare of naked lamps. This should render "R. E.'s visual activity" equal in both cases. I do not assume that it is impossible to direct the light with indirect fittings, but experience teaches that you cannot presuppose that every man who installs this system is a lighting expert, neither is the working plane for ever a fixed position. I take it that any alteration of this would mean a different set of reflectors and chain lengths, or would it be necessary to alter the height and contour of the ceiling, in order that the relative positions of the reflecting surfaces might remain the same? It certainly seems to open up prospects of good business for the consulting engineer.

I would ask "R. E." where I imply that indirect fittings are necessarily ugly. I think that even "R. E." himself will agree that some indirect fittings beggar description. Others admittedly look very nice in print, but in use the illumination of the fitting itself is such as to render its artistic design unnoticeable. In fact, its appearance with lamps burning resembles a big black patch, intensified by the white background.

Then there is the vital question of dust collection, which "R. E." does not touch upon. I have seen fittings which, after a month's use, cease to have any reflecting value whatever. No, "R. E.," I think you really admit to yourself in quiet moments, that indirect lighting leaves the Supply Co., and the lamp and fittings manufacturers, with a temporary increase of profit, which will rapidly disappear when the user awakens to the fact that he has been bluffed. Meanwhile, our competitors concentrate on efficiency and romp ahead.

H. A. W.

Long-Range Instruments.

Mr. Davies's last letter on this subject compels me to point out that Mr. Record did not write the article in *Electricity* which has been the *casus belli*. I might reasonably dilate upon the fact that it was hardly courteous of Mr. Davies not to have contributed his letters to *Electricity* as well as to the ELECTRICAL REVIEW and the *Electrical Times*. Without, however, going further into this matter, and without entering further into the discussion itself than to point out that the Record instrument possesses merits realised in no other *commercial instrument*, may I emphasise the fact that neither Mr. Record nor his representatives framed the article in question, which, moreover, they did not see till after its publication. The article was written after hearing

the inventor's views and thoroughly inspecting the instrument. As to the wording of Mr. Record's advertisements, I disclaim all responsibility. I do not propose to contribute further to this discussion should it be prolonged. My present motive for writing is to free Mr. Record and *Electricity* from an unjust imputation.

The Writer of the Article.

London, W., *June 3rd*, 1913.

I must apologise for again encroaching upon your valuable space to continue, as "Electricity" so aptly puts it, an "unnecessary correspondence," but when one's veracity is challenged, defence is advisable.

Mr. Davies now knows, to his discomfort, the result of his rashness in jumping to conclusions, and it only remains for me to repudiate the alleged inaccuracy of my firm's advertisement: "We are the only makers of long-scale instruments for direct current; all other long-scale instruments are for alternating current, and will not work on direct current." This announcement was not only correct, but justified.

Mr. Davies states it is erroneous in a twofold sense—first, because Messrs. Johnson & Phillips have produced a hot-wire instrument, and second, because "we have still our old friend the Cardew." To bring in the Cardew to give the lie to such an advertisement is ludicrous, and to bring in J. & P. for that end is unfair, because Mr. Davies must know that Messrs. Johnson & Phillips only brought their instrument to public notice for the first time three months after the introduction of my instrument, and *after the appearance* of my firm's advertisement, and Messrs. Gambrell have not yet done so. This disposes of Mr. Davies's unwarranted attack.

In conclusion, if M. Carpentier, followed by Mr. Davies, produced long-range instruments of the moving-coil type 20 years ago, succeeded by several years in which long-range instruments of the moving-coil type have been commercially unobtainable, it cannot be denied that the Record Electrical Co., Ltd., started with their unique instrument a new era in January, 1913, so far distinguished by the greatest anxiety on the part of those interested to make it appear that such instruments have always been available, coupled with frantic haste to develop rival articles to support the suggestion.

I wish to thank "Electricity" and the real "Writer of the Article" therein for their letter of June 5th, and for the high tribute they have paid to my instrument.

J. Westmoreland Record.

Broadheath, *June 9th*, 1913.

The Mutual Protection of Engineers.

Our suggestions towards the formation of the proposed Association will be submitted for publication in your next issue. A little delay is almost inevitable, the preliminary work being such that it can only be done slowly. The general opinion, so far, is keenly in favour of the Association. It is respectfully requested that reports be sent in as soon as possible, whilst progress would be facilitated if engineers in general would kindly canvass their friends with a view to our securing, at an early date, the number of those gentlemen who would be likely to give the Association their support.

L. H. Fletcher,
Hon. Acting Secretary, Proposed Association.
31, Queen Victoria St., London, E.C.,
June 9th, 1913.

I am not actively concerned with the formation of the suggested Association, but I have drawn my own conclusions as to the reason in pressing for combination. Nor am I sure that an Association could eliminate a case like my own; but I will give the facts just as they are.

Until about a year ago my career was all I could desire. My services were sought, and my salary was a good one. Then an important hitch arose a few months ago. I applied at once for another position with a competitive firm who had always been friendly towards me, and though I requested almost 50 per cent. increase in salary, the first interview was satisfactory.

It was at a subsequent interview that things were somewhat different. I was offered very little more than my old firm were paying me, and was told what that amount was to a shilling. My blank refusal to consider such a proposal might be expected; but at length I was led to suppose that the position would be offered me practically at my own terms when the preliminaries were completed.

About a week later, to my surprise, I was notified that the company in question had not been able to decide in my favour, and it now appears that each application I make to other firms gets only so far. I do not wish to publish my personal conclusions, but it is apparent that as engineers we are not to have a free hand in estimating our own commercial value. An Association might, therefore, well consider such cases, as they should concern every engineer who is an employé.

From every standpoint, however, I wish the proposed Association success, despite my doubts that my brother engineers will rally round it in time. We somehow appear to comprise so much of that unique stuff of which the middle-class man is made; and instead of asserting ourselves we plod on patiently, complaining only in secret. Those above and those below us are more than ever at pains to save their own skins, but we middle-class folk do nothing, unless it is to earn the contempt of the two sections of society between which we are situated.

We are subject to ever-increasing taxation for the benefit of the workman, the particular investments of our own class have depreciated, and the cost of living has risen, but we don't stir a finger for our own good. I add this, of course, because members of the engineering profession form so great a part of the middle-class, whose doom it is to be harassed, taxed, weighed down by increasing burdens, and left vaguely to mutter and grumble, wondering why someone—anyone but ourselves—doesn't do something.

It is not too much to suggest that the engineering profession represents the standard of ability in the country, and that brains were never of such account as now. As a body, we are therefore getting our deserts. It would appear that if we are to benefit ourselves to any extent the shackles of apathy and snobbery must at least be removed. We must adopt the team spirit—the spirit of cricket as opposed to that of golf. Indeed, it is not unlikely that we will soon have to go to Trade Unionism for our lesson, and, rejecting its glaring errors, adopt the obvious good points. Like the mechanic we would then learn to speak of "us," and not of "me."

If the Association will help to awaken our class to a sense of its duty to itself, I sympathise with those who are striving for its initiation.

Salesman.

You do well to call attention in your last issue to the absence of honours conferred upon those directly associated with engineering. Your article on "Municipal Parsimony" was likewise necessary, since such instances of municipal ignorance should be pointed out. Another such example was referred to in a recent issue of the *Manchester Guardian*, and should be of interest to those who are now endeavouring to improve the status of the engineer. The latter case concerned an advertisement inserted in the technical Press on behalf of the Shambrook Reformatory. This public institution is in need of a tall, smart, young engineer and electrician, apparently to look after its heating, lighting and power services. In addition, he has to assist with any other institution duties; which might mean anything from sweeping floors to teaching a class in grammar. He has also to be fond of boys (bad boys, presumably, since it is a réformatory), and able to play cricket and football well. In return for these varied services he will receive board and lodging, in addition to the princely salary of £40, rising to £48. Forty pounds a year seems to be about 16s. a week, but the advertisement also specified that the successful applicant should not have been guilty of the indiscretion of marriage.

Among other things, such advertisements serve to demonstrate the astounding conception which even public officials have of the status of an engineer. They also show how much skill is believed to be necessary to take charge of engineering plant and to perform all repairs, renewals, and modifications called for from time to time.

If an association were formed as suggested it might turn its attention to this question without delay. Perhaps it

might even be able in some way to render assistance to an engineer whose pecuniary circumstances tempt him to apply for such positions.

F. V. Robertson.

June 7th, 1913.

Having read and re-read the illuminating letter of "M.Sc." in your current issue, and being sufficiently an engineer to refuse to acknowledge myself beaten, I will be content with the non-commital comment of—"Exactly!"

To return to our subject, however, I am glad to note that the interest of the men concerned, appears to have been awakened by the letters which have recently appeared in your hospitable columns, and I believe that the announcement promised by Mr. Fletcher, is being eagerly looked forward to.

I make no doubt that a very few years ago the idea of any combination of the members of the engineering and commercial staffs of our various industrial concerns on Trade Union lines would have been very repugnant, but there seems to be little question now as to its necessity and advisability. With a combination of masters on the one side, and of operatives on the other, we, the individuals (at the present stage), must be wary or the usual fate of the unconsidered trifles caught between the upper and the nether millstones, will be ours.

Combination of some kind is certainly necessary, and I believe any steps to this end will meet the hearty response of those whom it is intended to assist, provided only that it is carried out on satisfactory lines, and is used as a weapon of defence, rather than of offence.

Mac.

I send you my Play on this particular subject, together with a cutting from the *Daily Telegraph*, which recently reviewed it at length, and, as you will see, glowingly. Any electrical engineer who is interested in the idea of bettering the status of the *engineers' draughtsman* is invited to communicate with the Society of Engineers, 17, Victoria Street, and to apply for a copy of the book as a loan to read, as the library of that Institution has some 50 volumes in circulation and is doing its level best to create an interest in the subject. It is hoped that the Play will be produced later in one of the more important London theatres.

Lloyd St. Clare.

Twickenham, *June 7th*, 1913.

[The title of the play is "A Woman of Imagination."—EDS. E.R.]

The "Times'" Time and Synchronising Turret Clocks.

With reference to the article in your issue of May 30th describing Mr. Kempe's method of keeping turret clocks to time, we would refer him to our well-known system which is working satisfactorily at the *Times* office and many other important buildings.

At the *Times* offices there are about 60 dials which receive an impulse every half-minute from a transmitter. The two turret clocks also work on the same circuit, being electrically escaped. The whole of the system has now worked many months without attention, and keeps time to within one or two seconds.

The recent reported failure of the bottom turret clock was due to a mechanical accident outside the clock, in which some of the wheels of this clock were smashed, but this accident is in no wise attributable to us.

The system is checked hourly by a signal bell actuated from Greenwich, and in view of your remarks under the heading of "The *Times*' Time," you may be interested in this statement, especially as this can be verified by reference to the engineering officials on the staff of the *Times*.

Gent & Co., Ltd. A. E. EATS, *London Manager*.

London, S.W., *June 9th*, 1913.

[As we understand the matter, Mr. Kempe's suggestions apply only to the synchronisation of ordinary existing clocks, whereas Messrs. Gent & Co.'s system relates to electrically-driven clocks—a totally different matter. We were not aware that their system was in use in the *Times* office, nor did we question the accuracy of the indoor clocks; our comments applied only to the public clock over the front door, the behaviour of which, until its recent repair, was very erratic.—EDS. E.R.]

PARLIAMENTARY.

Wood Green Electric Lighting Transfer.

MR. HERBERT CRAIG'S Select Committee of the House of Commons has passed the preamble of the Tottenham and Edmonton Gas Bill, which provides, *inter alia*, for the transfer to the company of the Wood Green Urban District Council's Electric Lighting Order.

MR. HONORATUS LLOYD, K.C., who appeared for the promoters, said that the electric lighting order was granted to the Wood Green Urban District Council in 1902, and it was at their suggestion that it should now be transferred by agreement to the gas company. In the early days of electric lighting the gas company contemplated seeking powers to supply electrical energy, and in 1897 they communicated with the various local authorities in their area to this effect. In the following year they obtained an Act which authorised them to apply for licences or provisional orders to supply electricity, and they intimated to the local authorities their intention to apply for provisional orders. On the local authorities intimating that it was their intention to make similar applications, the company abandoned their scheme. In 1902 the Wood Green Council obtained their electric lighting order, but although various schemes had been put forward, nothing had actually been done in the matter. In 1911 the Council approached the promoters and inquired whether they were still wishful to undertake an electric lighting scheme for the district, and after negotiations between the parties, the present Bill was agreed upon. The Bill contained the usual provisions for purchase under the terms of the Electric Lighting Act, and, in addition, there was a clause, by which the local authority could purchase the undertaking in 1928 by giving 12 months' notice, on payment of the capital expenditure plus 20 per cent.; in 1929 by payment of the capital expenditure plus 19 per cent., and so on for each succeeding year until 1948, when the Council would be able to purchase by simply paying the capital expenditure. The maximum charge for lighting under the proposed Order would be 5d. per unit; for power 2d. per unit; and for public lighting 2½d. per unit. Having cited instances to show that it was not a new idea to entrust a gas company with an electric lighting order, Counsel proceeded to deal with the opposition of the Printers' Almshouse Corporation, who alleged that the site for the proposed generating station would constitute a nuisance. Mr. Lloyd contended that the station would neither be a nuisance nor create a noise, seeing that gas engines were to be used for the generating plant.

After hearing evidence for and against the Bill, it was ordered to be reported for third reading.

West Bromwich Corporation Bill.—The Omnibus Bill of the West Bromwich Corporation which includes powers to provide and work trolley vehicles and motor omnibuses, make street improvements, &c., has been approved by the Select Committee of the House of Commons, presided over by Mr. E. Gardner. Mr. C. C. Hutchinson, K.C., who, with Mr. Jeeves appeared for the promoters, said the total tramway capital of the Corporation was £117,000. It was proposed to run trolley vehicles on six routes and the estimate for the proposed new trolley vehicles and equipment was £18,197 and for motor-'buses £8,000. The new lines were intended to give a through means of communication to the workers in the industrial areas who had now to walk long distances between their homes and their work. Mr. H. Lloyd, K.C., appeared for the South Staffordshire Tramways Co, who are the lessees of the promoters, and who contended that if the powers were granted their traffic would be taken away. After a consultation with counsel, the Committee passed the Bill subject to the route from Greet's Green to Greet Bridge not being constructed or worked except with the consent of the lessee company during the unexpired term of the company's lease. The same condition was laid down in the case of the All Saints to Wednesbury and All Saints to Walsall routes.

Various Bills.—In the House of Lords on June 5th the Northern Counties Electricity Supply Bill, Chesterfield Corporation Railless Traction Bill, and Westgate and Birchington Gas and Electricity Bill passed second reading.

In the House of Lords on June 9th, the Dundee Corporation (Improvements and Tramways) Bill was read a third time and passed.

In the House of Lords, on June 10th, the Kent Electric Power Bill and the Rhondda Tramways (Railless Traction) Bill were read a second time. The Herne Bay Gas and Electricity Bill was read a third time and passed.

Colinton Tramways.—Mr. Jeune, Examiner, has found that Standing Orders have not been complied with in the case of the Colinton Tramways Bill, owing to the promoters not having obtained the consent of the Edinburgh Corporation, who are the road authority, to the proposed extension. The Bill will go before the Standing Orders Committee, who will decide whether it will be allowed to proceed.

Leatherhead and District Electric Lighting.—The opposition threatened to the Leatherhead and District (Extension) Order in the Electric Lighting Provisional Orders (No. 2) Bill has been withdrawn, and consequently the order to commit it to a Select Committee has been discharged.

Electrical Exhibition in Spain.—At a meeting lately held in Barcelona, at which representatives of about 300 firms were present, it was decided to organise an International Exhibition of Electrical Industries in that city. A syndicate was formed at the meeting to take the necessary steps to carry out the idea.

LEGAL.

THE NATIONAL TELEPHONE AWARD.

IN the House of Lords on Monday, June 3rd, an appeal was heard before the Lord Chancellor and Lords Loreburn, Atkinson, Shaw, Moulton and Parker in the case of the National Telephone Co. (in liquidation) and Another *v.* His Majesty's Postmaster-General. The appeal was from an order of the Court of Appeal, dated April 16th this year, whereby it was declared that the Court had jurisdiction to hear an appeal by the Postmaster-General from the Court of Railway and Canal Commission sitting under the authority of an agreement between the company and the respondent, dated February 2nd and August 8th, 1905, and the Telegraph (Arbitration) Act, 1909.

The counsel for the appellants were Sir C. Alfred Cripps, K.C., Mr. Danckwerts, K.C., and Mr. H. H. Gaine. Counsel for the respondent: The Attorney-General, the Solicitor-General, Mr. Buckmaster, K.C., Mr. Schwabe, and Mr. Branson.

The ATTORNEY-GENERAL said he desired to be heard on the preliminary objection that their Lordships' House had no jurisdiction to entertain the appeal. He submitted that there was an appeal from the decision of the Railway and Canal Commission to the Court of Appeal on the construction of the Act of 1909, but that their decision was final.

LORD LOREBURN: Can we properly hear your objection until we have heard Sir Alfred Cripps, whose argument, I understood, was to be that the Court of Appeal had no jurisdiction to make the order from which he now appealed?

The ATTORNEY-GENERAL: I am quite content that appellants' counsel should be heard. I only desired to make this point to your Lordships before you heard the appeal opened.

SIR ALFRED CRIPPS, K.C., then proceeded to open at some length the case of the appellants. He argued that if the Railway and Canal Commission had the power to entertain the arbitration it was apart from the provisions of the Arbitration Acts of 1873 and 1888. The right of appeal was a substantive right and not one of procedure. It was a right of legislation and jurisdiction. He went on to quote the sections of the Acts of 1873 and 1888 and also the Act of 1909 in order to support his contention. Next he read the judgments of their Lordships in the Court of Appeal, maintaining that there could be no proceedings under the Act of 1909 except by the consent of both parties, which the majority of the Lords Justices in the Court below had overlooked.

MR. DANCKWERTS, K.C., followed on the same side, elaborating the point that a right of appeal could not be derived by implication. That right could only be given by direct legislation, and there was no such authority here. Even if jurisdiction had been given to the Railway and Canal Commission, it did not necessarily follow that jurisdiction had likewise been given to the Court of Appeal.

The LORD CHANCELLOR said: Their Lordships were unanimously of opinion that the preliminary objection raised by the Attorney-General to this appeal being heard could not succeed, and that they were entitled to decide the appeal which had been opened and argued for the appellants. No case had been made out which rendered it necessary to hear the respondent in reply. They thought the appeal failed, and they would give their reasons in writing hereafter for coming to that conclusion. But as the case was one which ought to be disposed of at once, they proposed in order to save time at once formally to dismiss the appeal, with costs, and affirm the judgment of the Court below.

The LORD CHANCELLOR then put the motion from the Woolsack, which was agreed to.

Solicitor for the appellants, William E. Hart; for the respondent, the Solicitor to the Post Office.

X.L. ELECTRIC CO. *v.* ARON.

BEFORE Mr. Justice Neville in the Chancery Division on Friday, June 6th, was renewed the motion by the plaintiffs in this action, by which they sought an interim injunction to restrain the defendant until the trial or further order from dealing with, or disposing of, certain patents relating to electric clocks, and from interfering with or withdrawing applications that were pending for protection for improvements in such patents, or for foreign protection.

MR. MORITZ, counsel for the plaintiffs, reminded his Lordship that in the previous week the defendant had given an undertaking and the matter had stood over for further evidence. They had just received an affidavit from defendant which dealt with several fresh matters, but with regard to the material part of the injunction the plaintiffs were asking for, he was quite prepared to go on with the motion. The position was that there were pending applications with regard to patents which came within the scope of the contract of the defendant with the company, and those applications he was threatening to interfere with. Clause 8 of the contract provided that if at any time the defendant should effect any improvements in the inventions relating to the patents he had assigned to the company, the patents for such inventions should be assigned to them they paying the necessary expenses incurred in obtaining protection. The defendant had made an invention which came within that clause before he quarrelled with the company and at the company's expense, and jointly with them he had applied for a patent. The Comptroller of Patents, in the exercise of the discretion vested in him, had declined to allow the application to proceed as an application for protection for an addition to a previous patent, and had decreed that the application must be for a substantive patent. The only difference was a question of expense, and the company was quite prepared to proceed with the application in accordance with the Comptroller's ruling. The defendant had, however, threatened to withdraw the application for a patent altogether. The attitude he took up was that if he could not proceed with the application as a patent for an addition he would withdraw the application altogether, and he did not in his evidence deny that he had threatened to withdraw it. There was also a threat on the part of the defendant to interfere with the foreign protection the defendants were seeking to obtain, but without going into the matter, if the defendant would undertake that he would not until the trial withdraw any of the applications that were pending with regard to the English and foreign patents, the company would be content, otherwise he must proceed with the motion.

MR. SIMMONS, for the defendant, said he was not prepared to offer any undertaking.

MR. JUSTICE NEVILLE asked what was the defendant's point.

MR. SIMMONS said that, with regard to the English patent, a time limit had been fixed, and subject to that time limit being extended his client was prepared to undertake not to withdraw the application; but with regard to the foreign patents, he could not give any undertaking, as he was merely a joint applicant. His Lordship ought to know that the defendant held two-thirds of the shares in the company.

His LORDSHIP asked who, under the agreement, had the conduct of these patent proceedings.

MR. MORITZ said that the action was undoubtedly in the hands of the company. Counsel then proceeded to read the affidavits filed in support of the motion, which set forth that the company was registered on November 28th, 1912, and was formed with a capital of £20,000 to take over the defendant's patents for an electrically-controlled clock, and up to the present time the defendant had refused to make any assignment of the patent.

MR. SIMMONS submitted that his client had not said that he would not carry out the agreement. The whole question was as to the manner in which the application for protection should be prosecuted. As to the assignment in an agreement for sale, it was always a condition that the vendor should have the goods to assign.

MR. JUSTICE NEVILLE said he was not deciding that point. What he had to decide was what was to be done with regard to the application for a patent. Where he thought the defendant was wrong was in thinking that he was entitled to have the sole right of saying how the proceedings with regard to the patent were to be taken. That was for the shareholders. They were the people who had control of the matter.

MR. SIMMONS: Your Lordship has heard how the shares stand.

His LORDSHIP said he could not look at that. What he had to consider was what the rights of the company were.

MR. MORITZ submitted that it was to the interest of everybody that these patents should not fall to the ground.

MR. SIMMONS said that there was an application for a patent in the joint names of the defendant and Mr. Harrison. Mr. Harrison should be made a defendant. Mr. Moritz said that that was the first he had heard of such a patent having been taken out, and it would be in fraud of the company's rights

MR. SIMMONS said that the company would be in a better position if they would abandon their present patent and take an interest in this new patent referred to in the affidavits. If that was clearly shown on the evidence, he submitted the Court would not interfere by interlocutory injunction. If the matter was allowed to stand until the trial, the defendant was willing to give any undertaking his Lordship might think right. With regard to the foreign patents, it was entirely a matter of policy, and there was no ground for an injunction, as the defendant had shown his good faith in making the application. With regard to the English patent, if it was allowed to go forward as a new patent, and not as an addition to the old patent, it would jeopardise a new patent which was now pending, and which, in the defendant's opinion, was much more valuable.

His LORDSHIP asked whether the company were prepared to undertake to pay the expenses of the pending applications.

MR. MORITZ said they were.

MR. JUSTICE NEVILLE: Then I need not trouble you further.

In giving judgment, he said that on that undertaking he must grant an injunction restraining the respondent from withdrawing, or permitting to be withdrawn, any of the existing applications, and from opposing or preventing or permitting to be opposed or prevented any application in connection with the patent rights subject to the agreement made between the parties. The injunction would extend until the trial or further order, and the costs of the motion would be costs in the action.

A Low-Compression Diesel Engine.—A patent has been recently taken out by Mr. Heinrich Zoelly, of turbine fame, to enable much lower pressures than usual to be used in the Diesel engine. According to *The Motor-Ship and Motor-Boat*, the idea is to heat the mixture of fuel and air before it is injected into the cylinder and comes into contact with the compressed air, so that the temperature of the latter, or rather its pressure, need not be so high as the 500 lb. per sq. in. pressure usually adopted. The interesting detail of the proposed system is the provision of a small electrical heating grid immediately under the fuel inlet valve, to heat the fuel mixture as it passes through. If the idea should materialise, it would enable a lighter type of engine to be constructed.

MINING MACHINERY EXHIBITION.

THE Exhibition of Mining Machinery, which was held at the Royal Agricultural Hall from May 29th to June 7th, contained an unexpectedly large number of features of interest to electrical engineers. The collection of coal-cutters, both electrical and pneumatic, was exceptionally large and varied, and indicates the rapid progress that is being made in the adoption of up-to-date methods of coal-getting in our collieries.

No attempt was made by exhibitors of pneumatic coal-cutters to challenge the great economy effected by the use of electric transmission—practically all of them, in fact, showed electrically-driven machines. MESSRS. MAVOR & COULSON, Glasgow, had a very large exhibit, including their well-known Pick-quick bar coal-cutters, driven by three-phase and direct current and by compressed air; their Samson disk coal-cutters, and a variety of other mining apparatus. A special feature of novelty was the use of air-cooling tubes in the Samson disk small size three-phase machine, in order to get the maximum power with minimum height. The motor is completely enclosed, dust and flame-proof, and the stator is provided with groups of straight brass tubes extending through the shell internally from end to end. A fan on the motor shaft (outside the shell) propels air through the tubes, and another fan (inside the shell) circulates the internal air over the surface of the tubes, thus cooling it without allowing the external air to enter the interior of the motor shell. The gears in these machines are mounted on sleeves running on fixed shafts, so as to give a very long bearing surface, which cannot be obtained when the shafts rotate in bearings fixed to the frame.

THE DIAMOND COAL-CUTTER CO., Wakefield, had a representative exhibit of their manufactures. Their 30-H.P. disk type longwall coal-cutter is fitted with an A.C. ball-bearing motor of the totally enclosed type; the gearing is all machine-cut, and mounted on substantial bearings, all end thrust being taken by ball bearings. A reversible valveless oil pump supplies oil to all bearings. The controller is of the drum type, worked by hand wheel from either end of the machine. A pivoted cable connector box of entirely new design is fitted, which, by releasing one thumb-screw, enables the adaptor to be swung round, thus ensuring a straight lead on the trailing cable. This prevents the cable having to be bent over when the machine is cutting back, and entirely obviates any risk of the cable being nipped between the machine and the props. The power factor of the motor is 0·82 at full load, and the efficiency is very high.

A bar type longwall machine was also exhibited, driven by a four-cylinder compressed-air engine, and a longwall chain machine, fitted with a 25-H.P. patented type D.C. compound-wound motor, having four main wound poles and two commutating poles, and ball-bearings. This is the firm's standard swinging jib pattern arranged to cut at floor level, and, like the other machines, is interchangeable for alternating current or compressed air.

A new gate-end winch for trailing cable, which should effect a great saving in the life of the cable, Blackett's patent coal-face conveyors driven by electricity and compressed air, and an improved friction clutch for use with A.C. motors, together with various patterns and sizes of this company's well-known safety type gate-end switch boxes and other accessories, were also shown.

MESSRS. ANDERSON, BOYES & CO., LTD., Motherwell, showed two disk longwall coal-cutters and one of the chain type, all electrically driven. One of the former was their latest pattern of three-phase machine, 8 ft. overall; the gear is very compact, and is provided with an exceptionally effective oil-thrower to render creeping impossible. Oil is pumped to the bearings. The shaft of the controller handle passes from end to end of the machine *inside* the frame; at the back end it can only be used to stop the machine, not to start it, so as to ensure safety to the men. The controller is of steel and mica construction, and the trailing cable plug is locked in place when the circuit is closed. Interlocking gate-end switch and fuse boxes were also shown.

MESSRS. A. HIRST & SON, LTD., Dewsbury, showed their "Crescent" machines, one of which was fitted with an electric motor. The insulation of the electrical parts of this machine is of mica, and flame-tight joints are employed throughout. Both D.C. and A.C. machines are made of the disk type. The drum controller in the former is provided with blow-out coils. Interlocking gate-end boxes and a coal drill were shown.

THE SULLIVAN MACHINERY CO., of London, though newcomers into this country, have many machines at work in the British Dominions, and have sold nearly 6,000 in all. The special feature of their three-phase coal-cutter was the small space occupied and the compactness of the motor, though the latter was rated at 30 H.P. for one hour continuously. The motor runs at 900 R.P.M. and is fitted with ball bearings; it is tested with a pressure of 5,000 volts A.C. The switchgear also occupies very little space, being simply a star-delta starting switch with no regulating appliances. The body of the machine is only 2 ft. 6 in. wide. The motor is started on light load, and is thrown into gear with a friction clutch, which is set to a predetermined maximum torque; a two-speed feed-gear is provided, giving a slow continuous feed for cutting and a fast speed (7 : 1) for "flitting," which renders the machine easy to handle quickly. A chain is used instead of a rope for the feed, and in the event of jamming in the cut the friction clutch protects the machine from damage. When a D.C. motor is used it is compound wound, preventing runaway. A reversing switch is provided, and all the controlling handles are close together at the front end of the machine. The feed can also be reversed without stopping the motor, and the machine can be run backwards without any delay. The friction clutch and change-gear levers are interlocked so that the pull on the feed chain cannot be increased beyond the normal value. The change-gear has also a neutral position, and the cutter chain can be instantly stopped with a jaw clutch. Altogether the machine presents a number of interesting features not met with in British types. The exhibit also included a compressed-air machine and rock drills.

Turning next to miners' lamps, the "CEAG" ELECTRIC SAFETY LAMP CO., LTD., London, had a large exhibit of their lamp—the winner of the first prize in the recent competition set on foot by the Home Office. Equipments were shown for charging simultaneously 80, 40, 24, 12 or 6 "Ceag" lamps, with 110 or 220 volts, the smallest of these sets being constructed in the shape of a "rescue shelf" in accordance with the new Rules. Racks for 200 lamps each, with number plates, magnetos for opening magnetically locked lamps, motor-driven cleaning machines, lamp wagons, acid filling apparatus, &c., were exhibited, as well as new and improved designs for lamp cabins, facilitating the distribution and collection of the lamps. Several special types of "Ceag" lamps for officials, lamps fitted with bull's eyes, sinking lamps of 16 C.P., &c., were also shown. We understand that many thousands of the "Ceag" lamp have been supplied to British collieries, with satisfactory results, the maintenance costs (inclusive of labour, material, repairs and energy) being not more than 2½d. per lamp per week—no more than for oil safety lamps. The works can turn out 3,000 lamps per week.

MESSRS. ACKROYD & BEST, LTD., Morley, showed amongst other lamps the Hailwood electric safety lamp, which is of the cylindrical type, with the lamp on the top. A single cylindrical accumulator cell is used, and the construction of the lamp is such that it is flame-proof, while it is easily opened for charging. A pneumatic or magnetic lock is provided, if desired. Special inspection lamps with lenses and reflectors are also made.

MESSRS. JOHN DAVIS & SON (DERBY), LTD., Derby, amongst a great variety of instruments and mining apparatus, showed the Gray-Suesmann type of electric lamp and lamp stands.

MESSRS. MANLEY & SANDY, LTD., London, were showing a new electric gas detector and indicator which they have devised. This is combined with a miner's electric lamp, and is housed within a small gauze cover on the top of the battery case; it is capable of detecting as little as 1 per cent. of gas, and can be adjusted in advance to a given percentage. The indication is produced by the catalytic action of a platinum salt, but does not depend upon current flowing through the platinum. An inspector's lamp is provided with a deflecting pointer, which shows the percentage of gas present (down to ¼ per cent.) on a divided scale. The lamp gives 1·2 C.P., and the battery will serve for one or two shifts, according to size. Effective precautions are taken to provide against explosion. Charging switchgear and a special small-power gas engine for driving a charging dynamo were also shown.

MESSRS. JAMES KEITH & BLACKMAN CO., LTD., London, had a large exhibit of their fans and blowers, many of them directly driven by electric motors. One of these, a ship ventilating fan, was fitted with a special watertight motor to run on deck. In the small fans, the blades of the runners are spot-welded. A mining fan with a capacity of 240,000 cb. ft. per minute, at 6-in. water-gauge, was one of the exhibits, and at the other end of the scale was a little portable blower for cleaning motors, &c., which could be carried by hand. Forge blowers, portable and fixed, and a gas compressor for the Keith high-pressure lamps, were other items of the exhibit.

MESSRS. HOBDELL, WAY & CO., LTD., London, had a very varied exhibit of engineers' supplies, including "Kulite" cork heat insulation in slabs and sections of all sizes, "Durite" belting suitable for the individual driving of looms, and for use in a moist atmosphere, conveyor belting, "Hobsleyte" asbestos sheets suitable for the cubicles of high-pressure switchgear and for roofing, and cork floor slabs for switch rooms. A special novelty was a tube scaler, consisting of four scrapers mounted on springs, which is driven by a flexible shaft, and in actual practice with water-tube boilers has been found to give exceptionally efficient results. The action is pure scraping without hammering, and the inside of the tube is left bright and clean.

MESSRS. BLEICHERT'S AERIAL TRANSPORTERS, LTD., London, showed a model of their ropeway in operation, as well as an electrical automatic telpher for conveying coal, &c. The whole of the control is effected from one spot, the tub being lowered or raised, and traversed, with only three wires. Very many such telphers have been erected, and the large ropeways have been built to carry up to 450 tons per hour.

MESSRS. JOHN DUGDILL & CO., Failsworth, showed a variety of their well-known patent movable fittings, and MESSRS. HANN AND INGLE, Manchester, their "Adaptable" earthing and continuity clips, which should be found very useful in mines.

MESSRS. HANS RENOLD, LTD., Manchester, had an exhibit of their silent, roller and block chains.

THE INGERSOLL-RAND CO., London, showed a large compressor driven by a Lancashire Dynamo and Motor Co.'s motor, and various rock drills, &c. A feature of the exhibit was the Temple-Ingersoll "Radialaxe" coal-cutting machine, which consists of a motor-driven pulsator connected to an air drill by two short lengths of hose. The air in the hose forms the medium by which power is transmitted to the drill, with perfect elasticity and high economy, as the air is never exhausted, but simply pulsates. The machine thus combines the advantages of electrical transmission to the working face and pneumatic operation of the tool. The whole equipment is mounted on a wheeled truck. The cutter is really a drill mounted on a special column, and, in fact, the parts are interchangeable with the company's rock drill.

MESSRS. W. & T. AVERY, LTD., Birmingham, exhibited a complete weighing and totalising machine, which automatically weighs

a constant length of the conveyor at suitable intervals, and records the total weight of material which has passed over the machine. The motive power is derived from the working of the conveyor itself. The machine was shown in operation with a Babcock and Wilcox gravity bucket conveyor.

Messrs. Reavell & Co., Ltd., Ipswich, exhibited their axial type compressor, motor driven, with an oiler at one end of the main bearing, whence the oil is forced by a spiral groove on the shaft to the working parts. The quadruplex compressor is fitted with automatic positive lubrication, the oil being forced through a filter to a tank, whence it gravitates to the working parts. A reversible valveless self-contained pneumatic mining hoist, substation cleaning set, &c., were also shown.

Messrs. G. M. Callender & Co., Ltd., London, showed bitumen sheeting, and "Bitusol" paint for the protection of iron and steel work.

The Electrical Apparatus Co., Ltd., London, had an exhibit of their starters and switchgears; a novel feature in an automatic triple-pole oil switch was a patent oil level interlock, which prevents the switch from being closed if the level of the oil is so low as to expose the contacts. A new A.C. meter of the induction type was also on view.

The Union Cable Co., Ltd., Dagenham Dock, appeared to be the sole representatives of the cable makers, with an exhibit of all kinds of cable, including bitumen-insulated mining cables and boxes.

The Coventry Chain Co., Ltd., Coventry, showed samples of their noiseless and roller chains and gears, and Messrs. Davidson and Co., Ltd., Belfast, had a large exhibit of Sirocco fans.

An ingenious sprinkling shovel for hand-stoking was shown by Mr. C. A. Fell, of Dronfield.

BUSINESS NOTES.

Heavy Capacity Lampholders and Adaptors.—We have received from Messrs. G. St. John Day (Patents), Ltd., a letter referring to the letter in our issue of June 6th, by Mr. C. J. Stonier, Dundee, in which they inform us that their Mumps and one-part adaptors, &c., will, and do, carry the same current as their Mumps holders; they guarantee these holders and adaptors, when used together, to carry 10 amperes. The only difficulty they experienced with large current-carrying capacity holders, adaptors, &c., was the size of the conductors entering or connected to such appliances, which necessarily required large holes. This difficulty has been overcome, and we have before us a Mumps lampholder and one part adaptor, coupled and wired with 7/22 wire and 130/40 flex. The makers inform us that they have tested the holders and adaptor with 20 amperes passing continually for 18 hours without heating up. The holder sent us is provided with side channels in the barrel to observe the method of contact making, as well as for heat testing, and it occurs to us that these channels might be made a permanent feature of the holders to allow of the circulation of air.

Electric Lamp Films.—At the Blue Hall Cinematograph Theatre, 207, King Street, Hammersmith, during this week, at 8 p.m. daily, there is being shown a special film illustrating the operations at the Osram and Robertson lamp works, with views of the employés at work and at play.

Dissolutions and Liquidations.—Johnson-Billington Electricity Meters, Ltd.—A petition for winding up this company, presented by Mr. W. H. Johnson, 62, Langham Road, Teddington, a creditor, is to be heard on June 17th.

Traction Supplies, Ltd.—Creditors should send particulars of their debts, &c., to the liquidator, Mr. T. Metcalf, 50, Frederick Street, Sunderland, by June 27th.

Adamson, Ramsbottom & Co., Ltd.—Creditors should send particulars of their debts, &c., to Mr. B. Cookson, 6, Castle Street, Liverpool, the liquidator, by July 31st.

Halpin's Patent Thermal Storage, Ltd.—A meeting is called for July 16th, at 5, Coleman Street, E.C., to hear an account of the winding up from the liquidator, Mr. S. V. Tiddy.

Bankruptcy Proceedings.—J. G. M. Hilton, electrical engineer, 103, Exchange Buildings, Birmingham.—The first meeting of creditors herein was fixed for Wednesday of last week, at Ruskin Chambers, Corporation Street, Birmingham, but the meeting was adjourned in order to enable the debtor to formulate a scheme by which the creditors would receive a composition of 7s. 6d. in the £.

W. Longdon and V. G. Cobb (Longdon & Cobb, electrical engineers), Nottingham.—Also W. Longdon (separate estate).—June 28th is the last day for receiving proofs for dividend. Mr. E. W. Humphreys, Official Receiver, 4, Castle Place, Nottingham.

C. S. Northcote, electrical engineer, Streatham.—A first and final dividend of $1\frac{5}{8}$d. in the £ is payable June 23rd, at 132, York Road, Westminster Bridge Road, S.E.

Book Notices.—*Reid's Handy Colliery Guide for Northumberland, Durham and Yorkshire.* Newcastle-on-Tyne: Andrew Reid & Co., Ltd. 2s. 6d.—This book opens with a large folded map of the district named in the title, showing the position of the collieries and the railways. It is largely a directory of colliery-owners, collieries, agents, managers and engineers, while it also contains lists of associations and institutions connected with the coal trade, and names and addresses of H.M. inspectors and assistant inspectors of mines. The latter half of the book and more is occupied with copies of Acts of Parliament and Coal Mines Orders, also the special rules for the installation and use of electricity, Workmen's Compensation Act, miscellaneous information and mining statistics.

The Practical Electrician's Pocket Book for 1913. Edited by H. T. Crewe. London: S. Rentell & Co. Price 1s. net.—The little red volume, which comes before us fatter than ever, though some of the old sections have been omitted, is unusually late this time; it only reached us last week. The new matter deals with electrical coal-cutting machines, vacuum cleaners, generators and motors, control of lighting circuits, measurements, &c. The field covered by the book is so wide and varied that it resembles an encyclopædia, and it is a mine of information in brief on electrotechnology.

The *Faraday House Journal*, Vol. V, No. 3, for June, which has just been issued, contains much information regarding the doings of old Faradians, as well as articles on the Dyott monoplane, Transformer Regulation on Inductive Loads, the Inductive Coupling of Oscillatory Circuits, and Electric Winding Plant for Collieries, with other matter, making it a very readable issue.

"Electric Wiring." By W. C. Clinton. Third Edition. 1913. London: John Murray. Price 2s.

"The Modern Bioscope Operator." 1913. London: Ganes, Ltd. Price 3s. 6d.

"Science Abstracts." Vol. XVI, Part 5, May 30th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Electricity in Mining." By Siemens Bros. Dynamo Works, Ltd. London: Charles Griffin & Co., Ltd. Price 10s. 6d. net.

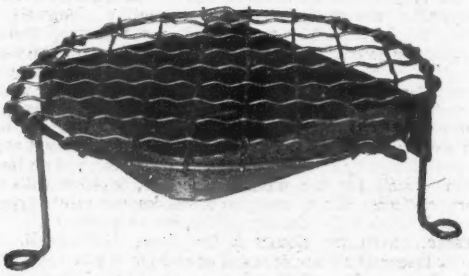
"*Journal* of the Institution of Municipal Engineers." Vol. IV, No. 16. May, 1913. London: The Institution. Price 1s.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 10. May, 1913. Johannesburg: The Institution. Price 2s.

"*Journal* of the United States Artillery." Vol. XXXIX, No. 3. May-June, 1913. Fort Monroe, Va.: Coast Artillery School Press.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 5. May, 1913. New York: The Society.

New Electric Stove and Toaster.—A new and cheap form of combined electric stove and toaster has just been placed on the market by Messrs. F. A. Wilkinson and Partners, Ltd., of Hatfield, Herts. The framework is



Electric Stove and Toaster.

constructed of bright wire, attached to which is a polished aluminium tray containing a simple form of heating element. The consumption is 600 watts, and the apparatus is of high efficiency. A slice of bread can be toasted both sides in $1\frac{1}{2}$ minutes, while 3 pints of water can be boiled in 22 minutes. Ordinary household utensils are employed, it being unnecessary to use those with flat bottoms.

Catalogues and Lists.—Messrs. Griffiths Bros. and Co., Macks Road, Bermondsey, London.—36-page booklet containing much information relating to their various insulating varnishes and compounds (Ohmaline, Armacell, Pakyderm, Insulderm, &c.) and the purposes to which they are applied.

Messrs. Veritys, Ltd., King Street, Covent Garden, W.C.—Folder No. 746 illustrates and gives prices of "Aston" fireproof and insulated lampholders, house service boards, tumbler switches, automatic two-part lampholders, ceiling roses and other devices.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—8-page pamphlet (No. 133) containing fully illustrated information relating to the erection and jointing of aluminium bus-bars and connections; tabulated areas, weights and other particulars of aluminium rod, bar and strip, are tabulated. Leaflet No. 222A shows the use of aluminium feeders for railway electrification. A special binder file accompanies the lists.

The Schniewindt Electric Co., 40 and 41, Staniforth Street, Birmingham.—Ten-page list, describing their electric stoves, in which Schniewindt resistance grids are used. Illustrations appear of some 17 designs, and prices, weights and dimensions are tabulated. Prices and particulars of the resistance grids are fully set forth.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—Leaflet relating to the "chain-pull" switch lampholder, and a supplementary price list of tumbler and other switches.

Messrs. Ross & Co., 62, Robertson Street, Glasgow.—Twenty-four-page illustrated wholesale and export price list of rubber

wires and cables, flexibles for lighting and motor-car service, bell, telephone, shot-firing and fuse wires, enamelled copper wires, cable sockets, sundries for dynamo repairs, &c.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—Folder, giving brief particulars, illustration and price of the "Magic" electric blower for factory and workshop service.

MR. FRED. J. DOWN, 6, 7 and 8, Crutched Friars, London, E.C.—Illustrated lists describing a spring hammer and drills for drilling holes in concrete, brick and stone. An extension for overhead drilling is shown, and typical ways of using the hammer are pictured. Other lists give particulars of gear shield—a graphite gear lubricant—such as is in use on a large number of tramways and railways.

THE ELECTRICAL CO., LTD, 122-124, Charing Cross Road, London, W.C.—Twenty-four page catalogue, illustrated, and giving prices, speeds, dimensions, weights, &c., of electric fans—ceiling, desk, porthole, swivel and trunnion, and other types.

MESSRS. KRUPKA & JACOBY, LTD., 26-36, Chapter Street, Westminster, London, S.W.—Illustrated and priced leaflet ("F"), giving particulars of electric fans—universal joint, swivel and trunnion movement, ceiling, porthole, propeller and desk types; also a list of prices of small power motors.

MESSRS. E. BENNIS & CO, LTD., 28, Victoria Street, London, S.W.—28-page catalogue in a brilliant "fiery cover," containing introductory comments on "cheap steam and a smokeless chimney," followed by a description of the construction and operation of the Bennis stoker. Tests results are tabulated both for a power-house and a cotton mill. Nine pages of interesting drawings follow showing the application and general arrangement of these stokers and furnaces to different types of boilers. One of the pictures shows the stoker arranged for gas firing as an alternative to coal firing; and another shows a Cheshire power station where 12 boilers are fired by the firm's machines, the coal used being a small slack.

THE STERLING TELEPHONE & ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Folder (No. 210), showing their receivers for wireless telegraphy, and stating prices.

Wheatstone Slip.—We have received from MESSRS. H. ERHARDT & CO., LTD., of 9-10, Bond Court, Walbrook, E.C., a sample roll of their Wheatstone slip, which is said to be free from oil, grease and fluff, and to keep in condition for any length of time in any climate. The sample is strong and crisp, with a clean sharp edge, and should prove admirably adapted for use with telegraph and time recording instruments.

Installation Contracts.—MR. JOHN RICHARDS, electrical contractor of Burton-on-Trent, has a number of complete plant installations in hand, particularly for country houses and industrial works. The country house installations include Wychnor Park, Lichfield; Coton Hall, Sudbury; The Gables, Rangemore; and Croft House at Grendon, where he has recently completed the electric lighting of Grendon Hall. Other work now in hand includes the complete equipment of the Nestlé & Anglo Swiss Condensed Milk Co.'s new factory at Ashbourne, Derbyshire, with some 28 motors, 350 lights, intercommunication telephones, electric clocks, &c.; Messrs. Warwicks & Richardsons' Brewery, Newark-on-Trent, with some 30 motors and 250 lights; Messrs. James Hole and Co.'s Brewery, Newark-on-Trent, with some 300 lights, besides numerous installations on town supplies.

The British Engineers' Association and Merchant Firms.—The Secretary of the British Engineers' Association (Caxton House, S.W.) writes to correct a misapprehension that the Association intends working against the interests of merchant firms. He thinks its existence is probably due to the Association having had to decline to elect a number of merchant firms of highest repute "simply because the membership is confined strictly to manufacturers." The Association being purely an organisation of manufacturers, a merchant or agent is not considered eligible Its members are at liberty to deal with merchants as much as and however they choose. It is sometimes asked whether the Association is working with the merchants, but the secretary says that as an Association it cannot do so; its members, however, do as they please. The Association's aim is to influence trade for the benefit of its members, the latter taking orders through any channel they may find convenient.

British Electrical Developments in China.—While increased attention is being devoted to the Chinese market in the hope of preventing golden opportunities slipping past our manufacturers, both now and in the future, it is satisfactory to learn that the GENERAL ELECTRIC CO., LTD., whose efforts in China are not unfamiliar to our readers, are very satisfied with their experience there. The General Electric Co., of China, Ltd., report that recently they have secured several contracts for the supply of electrical machinery for the Chinese cities of Soochow and Changchow, in Kiangsu Province. All electrical plant and materials in these places will be of British make and manufactured at the works of the G.E. Co., Ltd., in England. For Soochow a Witton single-phase alternator, capacity 375 KW., with high-tension switchboard, is being supplied as an extension of the present generating plant. In the case of Changchow, which is a similar city, a Chinese company has been formed, and the contract secured for a Witton alternator of about 200 KW., complete with high-tension switchboard, Allen's engines, &c. Another contract recently secured has been for three Witton high-tension alternators, with 14-panel switchboard, for the lighting of Fatchan, in Kwangting Province. The General Electric Co., of China, Ltd., was only established in 1911; its headquarters are at Shanghai, and sub-branches are located at Hong Kong, Tientsin and other places.

Trade Announcements.—We understand that some confusion and inconvenience has arisen owing to correspondents failing to address letters correctly for firms of somewhat similar title at Walsall. Readers are asked to take note that the address of the Walsall Electrical Co., Ltd., is 57, Bridge Street, Walsall, and that of the Walsall Hardware Co., who manufacture conduits and fittings, in the directories is Walsall only. Mistakes have also occurred in the correspondence of these two concerns and that of the Mechanical and Engineering Co. Each of these firms has lately received letters intended for one of the others.

THE HALLAMSHIRE ELECTRIC CO., LTD., has removed to 16, Carver Street, Sheffield.

THE BENJAMIN ELECTRIC, LTD., announce that their accounts and order departments are now managed at the company's works at 1A, Rosebery Avenue, E.C. (telephone No. "City 2407"), and all communications relating thereto should be sent to that address. The sales office and showrooms are still at 117, Victoria Street, S.W. (telephone No. "Victoria 1297").

MESSRS. FALK, STADELMANN & CO., LTD., have arranged for permanent showrooms at 107/111, Shudehill, Manchester, for the display of electrical fittings and accessories of every description, and a complete stock will be carried.

We understand that MESSRS. BAXTER & CAUNTER, of 219, Tottenham Court Road, W.C., are rearranging their switchboard department, putting it under new management, particulars of which will be duly announced. Mr. L. B. Best is no longer associated with the firm.

Low-Water Alarm and Feed Regulator.—We regret that the address of MESSRS. ELLEFSEN & CO., makers of this device, was wrongly given in our last issue. It is 26A, Silver Street, Bedford (not Bradford).

LIGHTING and POWER NOTES.

Ashford (Kent).—At a meeting of the U.D.C. on June 5th, an application was received from the East Kent Electric Supply Co. for permission to use overhead wires for the supply of current under the order held by the company. The matter was referred to a Committee for the collection of further information.

Banff.—The Lunacy Board has under consideration the lighting of Ladysbridge Asylum with electricity, at an estimated cost of £1,100. It is calculated that by adopting electricity a saving of about £100 per annum would be effected, as the gas installation costs a good deal annually for repairs.

Barnstaple.—The income from the electricity undertaking for the year ending March 31st, 1913, amounted to £5,400. The expenditure totalled £3,062. There is, therefore, a profit balance to carry forward of £2,337. The capital account shows an unexpected balance of £99, the expenditure being £33,385.

Bedford.—The L.G.B. has informed the T.C. that the inquiry into the application for a loan of £11,590 for additional plant at the electricity works will be reopened on June 18th by Mr. T. C. Ekin. There have been two previous inquiries concerning the loan, particulars of which have appeared in the ELECTRICAL REVIEW.

Belfast.—The two years' discussion on the proposed new power station does not appear to bring the matter any further towards a settlement. Mr. Bloxam's report upon the estimated comparative capital and working costs of the various sites has been issued, showing considerably in favour of the harbour sites in the matter of working expenses. The capital expenditure on an 18,000 KW. station, including over £100,000 for machinery, is estimated at between £183,000 and £202,000 according to the site selected.

For the year ended March 31st last, the Electricity Department shows a working profit of £34,947 carried to net revenue account, to which has been added £1,380 for bank interest, making a total of £36,327. After providing for fixed charges, amounting to £22,478, income-tax, &c., there remained to the credit of the new revenue account a disposable balance of £13,175. The appropriation of this sum will be considered at a later meeting of the T.C.

Bradford.—The city electrical engineer has been instructed to furnish members of the Electricity Committee with a copy of the report presented by him upon suggested extensions of the generating plant, together with an estimate of the capital cost involved. The Committee is to hold a special meeting at an early date, and to proceed to Newcastle, Manchester and other towns to inspect the electrical undertakings.

The electrical engineer has also been instructed by the Committee to proceed with the work of extending existing E.H.T. feeders at an estimated cost of £5,458.

Burnley.—A statement prepared by the borough treasurer and submitted to the T.C. shows that the actual profits from the electricity undertaking on the past year's working amount to £7,926. This is £3,133 more than the amount estimated.

Bristol.—In his annual report to the City Council, Mr. Proctor, the city electrical engineer, says the Electrical Committee has agreed to reduce the charge for public street lighting by £2,000 per annum and to give a supply of current free of all charge to numerous incandescent electric lamps on the line of route of the mains. Cooking by electricity has been introduced, and is rapidly becoming popular. The number of cooking stoves in use would have been appreciably larger, but for the difficulty experienced in obtaining sufficient deliveries from the manufacturers, who throughout the country are overcrowded with orders. The increase in the connections to the mains, reduced to the equivalent of 30-watt lamps, is 65,068. This is the greatest increase in any year since the commencement of the undertaking, except only the year 1908-9. The total connections to date amount to 639,523; 15,000 H.P. of motors on consumers' premises are now supplied, over 2,000 H.P. having been added during the year. The total sale of energy has increased 25 per cent. The total revenue from the current sold has risen from £73,335 to £82,130, an increase of £8,795, as compared with an increase of £5,072 for the former year. The gross profit on the year's working is £56,129. The Committee has opened a general reserve fund this year, to the credit of which it has placed the sum of £6,000.

Burton-on-Trent.—Application has been made to the L.G.B. for sanction to the borrowing of £5,000 for 25 years for mains and feeders, £1,500 for 15 years for services, and £2,000 for 15 years for transformers and sub-stations.

Bury.—Mr. S. J. Watson, the borough electrical engineer, in his just-published annual report, states that the total units sold for all purposes were 5,076,634 (of which 1,370,266 were for tramway purposes), as against 4,220,191 (1,340,355 for tramways) in the preceding year. The total generating costs were ·55d. per unit sold, compared with ·62d. per unit last year, and the average price obtained for the total output was 1·05d. per unit, compared with 1·10d. per unit for the previous year. After payment of all working expenses there was a gross profit of £10,577, equal to 6·49 per cent. on the average capital employed, compared with £8,472, equal to 5·65 per cent. on the capital for the previous year. The sum of £11,219 was required to pay interest on loans and sinking fund, leaving a debit balance of £642, which had been taken from the reserve fund. During the year £7,066 had been expended on new mains, services and transformers. Although a loss of £642 has to be recorded, adds Mr. Watson, the general position of the undertaking shows a marked improvement over the previous year, and the next accounts will probably show that the undertaking is once more established on a profit-earning basis. Commenting on the report at the T.C. meeting on June 5th, Councillor Jamieson said the capital charges and the working expenses had now reached a normal level, and all additional income would consequently yield a much larger percentage of profit.

Canterbury.—During the year ended March, 1913, the sum expended on capital account on the electricity undertaking amounted to about £766, making a total expenditure of £70,188 up to date. The income from sales amounted to £10,088, as against £9,557 in the previous year. An increase of 7 per cent. in private consumers is reported. The expenditure was £5,706, against £5,263; the gross profit of £4,954 shows a return of 7 per cent. The net profit, after providing for interest, income-tax, capital repayment, and sinking fund of £3,981, wass £972; £174 had been expended for the purchase of the free wiring installations, and apart from that the profit would have amounted to over £1,000 during the year.

Charnmouth.—An electric lighting scheme for the village has been propounded by Mr. C. H. Steele, who proposes to use local water-power and to invoke the aid of the Dorset Electric Lighting Co.

Cheltenham.—The T.C. has applied to the L.G.B. for a loan of £2,000 for prospective mains extensions.

China.—According to the *Indian Textile Journal*, the Kwangtung Electric Co. is extending its lighting cable to Fati, on the other side of the Canton river. The town named is the terminus of the Canton-Samshui Railway and boasts of quite a number of European godowns and residences. To meet the new supply, two additional Diesel engines and dynamos of 300 KW. each are to be installed, capable of giving 30,000 lights. These additions will bring the company's plant up to 12 engines.

Clacton-on-Sea.—The U.D.C. has received from the L.G.B. sanction to a loan of £6,000 for electricity purposes, £5,390 being for a Diesel engine, and £610 for extensions to the generating station.

Colne.—The Corporation has received the sanction of the L.G.B. to the borrowing of £2,000 for the purpose of extending the electricity mains.

Crewe.—The T.C. has received the sanction of the L.G.B. to a loan of £430 for converting to electric lighting certain street lamps in the North Ward of the borough.

After paying all costs, there is a surplus of £1,329 on the electricity undertaking for the year ended March 31st. Of this amount, £600 is to be applied in aid of the general district rate for 1913-14.

Dartford.—The electrical engineer has been authorised to issue an illustrated pamphlet calling attention to the cheap rates at which energy is supplied to power consumers and to the advantages which the locality affords for the erection of factories.

Dudley.—In connection with the sale of the Corporation's electricity undertaking, a deadlock arose owing to the limitation on both sides of the statutory powers; but, as a result of a special meeting of the Council in reference to this matter, all difficulties have now been overcome. Under the new agreement, as under the original one, all losses which the Corporation has sustained in connection with electrical supply will be refunded. A rearrangement of the working plant, to be carried out at a cost of £20,000, is to include the erection of transforming plant to give high-pressure current on, it is believed, more favourable conditions to consumers. It is understood that the sale can now be completed without any public inquiry.

Dundee.—Treasurer Soutar, dealing with the Corporation electricity accounts at a meeting of the Town Council, said the year had closed with a net profit of £7,028. Although this was fully £3,000 less than in the previous year, it was accounted for by the increase in coal cost and assessments. The total units sold were over 10,000,000, showing an increase of 1¼ millions, and the total revenue was £52,390, an increase of £3,000, in spite of the fact of considerable reductions made in the price. Practically the whole of the increased units sold had been for power purposes, although there was also a gratifying increase in the units sold for lighting. The whole of the net profit had been placed to reserve fund, which now amounted to £21,781. Councillor Don congratulated Mr. Richardson, the Corporation engineer, and said the result was an ample answer to the complaints about continuous expenditure on capital account, and to the criticism which was offered when they decided to go to Carolina Port; he thought it was only after they had increased the power demand that they could hope to grant any advantage to the consumers for lighting. The accounts and estimates were approved, the charges remaining unchanged.

Eastbourne.—The annual report of Mr. J. K. Brydges, the borough electrical engineer, on the work of his department, shows that the income of the year was £27,860, the gross profit £14,476, and the net profit £2,495, which compares with £1,089 in 1911-12. The total energy sold was 1,620,648 units, as compared with 1,432,323 units in 1911-12.

Eccles.—In regard to the figure of £112, given as the net profit of the electricity department for the past year, Alderman Pearson explained to the Council last week that the sum was estimated at the time the price to be paid by Salford was in dispute. The Council had now practically agreed as to a price, and the profit would be £380. That, however, was a decrease on the amount under the old arrangement. Referring to the revenue account, he pointed out that, after paying for all working expenses, there was a gross profit of £4,193, which was slightly over 7 per cent. on the capital invested.

Epsom.—The U.D.C. has decided to apply for sanction to a loan of £480 to carry electrical cables to the Woodcote Park Estate. If supplied with current, the Royal Automobile Club, which has premises on the estate, has guaranteed £60 revenue per annum for three years.

Elland.—The Council last week confirmed the recommendation of the Electricity Committee that in future electricity for public lighting be charged at the rate of 1½d. per unit. It was reported that the number of consumers was now 349. The total output for last month was 35,440 units, a decrease of 1,331 on the previous month, and an increase of 16,419 on the corresponding period of last year.

Felixstowe.—The U.D.C. has decided not to reopen negotiations with Dr. C. H. Lieberbrand on the subject of the transfer of the electricity undertaking, or to have any further correspondence with him on the matter.

Gillingham (Kent).—The T.C. has decided to supply electrical energy to the Admiralty for the Naval Hospital, for heating and cooking, at 1d. per unit on a guaranteed minimum consumption of 50,000 units per annum, or 1½d. per unit without such guarantee.

Gloucester.—Subject to a satisfactory agreement, the T.C. has decided to supply current for lighting and power to Messrs. Spillers & Bakers' flour mill. A cable will be run through a pipe under the canal.

Halifax.—At a meeting of the T.C. last week, the Electricity Committee recommended that the charges for electricity for lighting purposes be 4d. per unit for accounts up to 1,200 units a quarter and 2d. per unit for energy supplied in excess of that amount. The vice-chairman of the Gas Committee moved that the minute be referred back, and was supported by several speakers, including the Mayor, who said that competition between the Electricity and Gas Committees, if carried to extremes, would kill both departments. The chairman of the Electricity Committee, in answer to the Mayor, said the two Committees had already met, but had not been able to come to any agreement. The warfare between the Committees was ridiculous. The motion to refer back was carried.

Hastings.—At last Friday's meeting of the Corporation, the annual accounts of the electric light undertaking (up to March 31st) were submitted by the borough accountant, and showed that considerable progress had been made. From the time when the undertaking was purchased by the Corporation from a local company—in 1898—the financial position has been handicapped by the heavy capital involved.

The income for the year was £22,327, showing an increase of £1,719 on the previous year; the expenditure was £10,669 and

the gross profit £11,658. After meeting capital charges, the net profit amounted to £557, and compares with £90 in the previous year. Both these amounts were transferred to reserve.

Hull.—On June 5th a L.G.B. inquiry was held by Mr. Hooper respecting the application of the T.C. for a loan of £1,800 for electric light fittings for the new Guildhall. Mr. Hooper pointed out that the proposed outlay was very high, being £4 5s. per light, and it was intimated that, if necessary, the Council would try and reduce the cost.

India.—The chief engineer of the Karachi Port Trust has been instructed to estimate the cost of the general lighting by electricity of the Port Trust properties at Keamari from the board's own installation.—*Indian Engineering.*

King's Lynn.—The abridged returns of the Electricity Department for the last year's working show a total income of £7,314, and after meeting working expenses and financial charges, a net profit of £876 remains, as compared with £503 in the previous year

Kirkcaldy.—The Electric Lighting Department returns show a loss of £37 on the last year's working. It was estimated, however, that the deficit would have been greater, but the raising of the rate for current supplied to the tramways from ¾d. to 1d. per unit has considerably improved matters.

The Council proposes experimenting with a new type of arc lamp for street lighting, with a view to economising in that department.

Korea.—The total amount of capital invested in electrical concerns in Korea is about £1,225,000. Of this sum £980,000 is invested in concerns already working, and the balance in electrical works which are in course of construction. During the year two new companies commenced operations. One supplies the town of Gensan with light and power, and is the only hydro-electric company in the country. The other supplies light and power to the town of Taikyu. Eight more companies which have already received official sanction are expected to commence work during 1913.—*Board of Trade Journal.*

Leigh (Lancs.).—It was reported last week-end that the profit on the municipal electricity department last year was £1,080. an increase of over £500 upon the previous year.

London.—STEPNEY.—The income of the electricity undertaking for the year ended March 31st last amounted to £78,434, being an increase over the previous year of £9,154, whilst the total expenditure amounted to £39,208, an increase of £8,123. This leaves a gross surplus of £39,226, as compared with £38,196, and represents a gross profit of 8¾ per cent. on the capital employed, which, in view of the very low tariff in force, the Electricity Supply Committee deem satisfactory. There has been an increase in the number of units sold during the 12 months from 11,972,955 to 14,580,982. With reference to the net revenue account, the total income, including the balance from revenue account, amounted to £39,834, against which are charged £27,278 for loan charges paid, £600 for stand-by charges, £8 additional provision for accrued charges, and £441 for certain temporary work, leaving a balance carried to appropriation account of £11,507, as compared with £12,757 the previous year. As regards this latter account, the total amount available, including £11,507 from the net revenue account and £2,254 brought forward from the previous year, amounts to £13,760, and it is proposed to charge against this account the following:—£1,125, representing expenditure in the nature of capital not borne by loan; £2,711 written out of the capital account in respect of assets (*i.e.*, machinery, meters and house services), now non-existent; and £8,443 transferred to reserve, carrying forward £1,482 to next year's account. The available balance on the reserve account was £21,193 (including the £8,443 transferred from the appropriation account), against which has been charged £193 cost during the year of removing plant from Whitechapel to Limehouse, leaving £21,000 carried forward to next year's account. Of this latter sum, £1,000 is reserved in respect of bad and doubtful debts. The known bad debts have been actually written off. The capital commitments during the year amounted to £26,834, and new loans amounting to £23,250, were taken up to meet this. The aggregate capital expenditure amounted to £461,114.

ST. PANCRAS.—The terms upon which the Council is to enter into an agreement with the London Housing Society for a supply of current to its residences in Judd Street are to be altered so as to provide that no supply shall be given except on the understanding that no gas is to be used in the buildings for lighting purposes. The Council's opposition to the London Electric Railways Bill has been settled by an agreement being entered into by which the promoters promise to pay to the Council £300. The Electricity Committee anticipates that, when the plant for the further extension of the principal generating station is installed, it may be able to make a further favourable revision of charges.

ISLINGTON.—Application is to be made to the L.C.C. for sanction to borrow £10,000 required in respect of high and low-tension distributing mains, meters, services and transformers for the ensuing year.

HACKNEY.—In connection with the coal contracts to March, 1914, for the first time alternative tenders were asked for "named" and "guaranteed" coal. The Electricity Committee, after analysing the tenders, feels obliged to recommend "named" coal, as in no case are the "guaranteed" coal prices sufficiently low, when the bonus for superiority to standard is taken into account. Offers by Messrs. Cory and Sons, at 16s. 7d. and 17s. 6d. per ton for "named" coal were accepted; the "guaranteed" prices comparable were 16s. 11d. and 17s. 1d.

Manchester.—The E.L. Committee has adopted the "Norwich" system of charging as an alternative rate (at the option of the consumer) to the existing tariffs for domestic supplies. The new rate is based on a fixed charge of 12½ per cent. on the net rateable value of the dwelling house, plus ½d. per unit metered for all supplies. The adoption of the new tariff is further contingent on the consumer agreeing to install for domestic power purposes a certain minimum number of kilowatts, according to the rateable value of the premises, in addition to the existing lighting requirements.

Middleton.—There is a loss on the year's working of the electricity department of £1,800, after allowing for £500 for depreciation. This is due chiefly to the high price of coal and to the breakdown which occurred. Although there is an increase in the number of consumers, the amount consumed has not increased, and the department has received £476 less for electricity supplied for traction purposes. The deficiency on revenue account is £1,124.

Morocco.—La Sociedad Hispano-Marroqui de Gas y Electricidad is the name of a company which has lately been formed, with a capital of £200,000, to acquire and carry on the central electric lighting station in the town of Melilla. The plant, which has a capacity of 800 H.P., is to be increased by the establishment of a new 600-H.P. station to enable current to be supplied to Nadar and other small towns in the district. A gas-works is also to be established at Melilla by the company.

Nuneaton.—The T.C. has reduced the price of current on the flat rate to 4d. per unit with ordinary meters, and to 4½d. per unit with slot meters.

Rochdale.—The Corporation Electricity Committee has under consideration the terms on which a bulk supply shall be granted to the Heywood Corporation.

Rhosllanerchrugog.—As the outcome of inquiries made by the local Traders' Association, the Welsh E.L. Syndicate has intimated that it is prepared to supply electricity to the town at 6d. per unit. Another scheme, whereby current could be obtained from Wrexham by means of overhead lines, has been submitted by the borough electrical engineer. The matter is being considered by a Lighting Committee appointed by the Association.

Roscrea.—The Council has granted to the Roscrea Co-operative Bacon Factory a lease for 21 years to put up poles and do other necessary work so as to supply the town with electric light and power, the factory to pay to the Council a nominal rent.

St. Helens.—At a meeting of the T.C., Sir Joseph Beecham, reviewing the work of the electricity department, said the income during the year amounted to £27,365, an increase of £1,339 over the previous year. On the expenditure side, the working expenses were reduced by £599 to a total of £13,344, so that the gross profit amounted to £14,821, which was a return of 7¼ per cent. on the capital. After deducting capital charges, there remained a surplus of £1,629, compared with £518. The total number of units sold was 4,890,438, an increase of 73,506 units. The power units amounted to 2,998,830, an increase of 5¼ per cent. over the previous year. In connection with the tramways supply, there was a decrease in the amount of energy taken of 57,609 units, or 4·2 per cent.

Salford.—At the T.C. meeting last week, the question of the public lighting of the borough was referred to the Lighting and Cleansing Committee for a report as to whether the lighting is efficient.

Sheffield.—The T.C. has engaged Mr. Haydn Harrison, of Westminster, at an inclusive fee of 100 guineas, to go into the question of the relative cost and efficiency of gas and electricity for street lighting.

Siberia.—According to a St. Petersburg paper, the Minister of Commerce has decided to equip the Port of Vladivostok with a number of electric cranes and other cargo-handling appliances, for which is allocated 1,000,000 roubles. A complete dredging plant is also to be acquired, at a cost of 300,000 roubles, for use at Ust-Kamchat Va, on the east coast of the Island of Saghalin.

South Africa.—Relative to the supply of electric current by the Durban Corporation at reduced prices, with a view to encouraging its use for domestic heating and cooking, H.M. Trade Commissioner for South Africa reports that the efforts of the Corporation are meeting with considerable success, and that electric heating and cooking are now fairly well established in popular favour in Durban.

Spennymoor (Co. Durham).—By 10 votes to 6 the U.D.C. has decided to utilise electricity for public lighting, and the tender of the E.L. Co. at £2 10s. per lamp per annum on a three years' contract, has been accepted.

Tilbury.—The County of London Electric Supply Co., which is applying for a prov. order for electric lighting, has informed the U.D.C. that it cannot include in the order the conditions desired by the Council as to the payment of Trade Union rate of wages, as it considers it outside the scope of the order. The question of opposing the company's application will be considered at a future meeting of the Council.

Wakefield.—The City Council last week decided to make application to the L.G.B. for powers to borrow £12,806 for the purposes of extensions to the electricity undertaking. During the last two years, it was stated, the expansion of business had been greater than during any similar period in the life of the undertaking. The output rose from 1½ million units in 1911, to 2½ millions in 1912, and 3¼ millions in the year just completed, and it was expected that the output would be at least 4 million units in the current year. The extensions consist of new generating plant, additional condensing plant, an additional boiler and the provision of a high-tension distributing station at the bottom of Kirkgate.

Wallasey.—The T.C. has adopted the recommendation of the Electrical Committee, referred to in our last issue, which proposes to construct a new three-phase power station at a cost of £65,000, near the Great Float, which offers facilities for obtaining both coal and water. The present generating station will ultimately be used as a transforming station and the Diesel engine set will be retained there for the time being.

Walsall.—The B. of T. has revoked the Midland Electric Power Distribution and Lighting (Extension) Order, 1901, for the Parish of Great Barr, in the Rural District of Walsall.

The sanction of the L.G.B. has been received to the borrowing of £3,000 in respect of prospective expenditure on mains.

Warrington.—At the T.C. meeting last week, Alderman Smethwick said the financial result of the working of the electricity department during the past year was very satisfactory, a profit of close upon £3,000 having been made. There had been a large increase in the consumption of energy for power and lighting, despite strikes and advanced coal prices.

Watford.—At the last meeting of the U.D.C. the Chairman of the Electricity Committee said that during the past year, though the charge for energy had been reduced ½d. per unit, which represented a loss of £1,000, the profit for the year worked out at £1,110, and after giving £850 in aid of the rates, they had carried forward £261 to the reserve fund, bringing that fund up to £1,533.

Wigan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £6,700 for the purpose of meeting the expenditure estimated to be necessary for the installation of a new turbine and accessories at the electricity works. The Council was informed by the Mayor that, at the present time, the engines were running at their fullest load, and in view of the large consumers that were coming on, the Corporation had to make provision for an increased output.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The revenue on the Corporation tramway system for the past year amounted to £80,150, an advance over the previous year of £2,970, and an increase in three years of £9,029.

At a meeting of the T.C., a scheme for an important development of the system was adopted, and it was agreed to borrow £50,000 to carry it out. Application will be made to Parliament for power to extend the track to the city boundary at Craiginches; to use railless trolley cars between Castle Street and York Place, and between Schoolhill and Forresterhill Road; and to use motor-omnibuses within and outside the city. It was also agreed that power be sought to apply one-third of the surplus receipts to the Common Good fund or towards the reduction of rates.

At a later meeting of the Tramways Committee, it was agreed to extend the route in the west end a distance of 1,263 yd. at a cost of £12,560. The Committee also recommended that the tramway manager's salary be increased by £50 to £450.

Belfast.—The amount at the credit of the tramway net revenue account for the last year was £28,801, and it has been agreed to apportion this as follows:—£13,000 to the depreciation fund, and £15,801 to the general purposes fund for the relief of rates. The city accountant also presented the accounts of the electricity undertaking.

Birkenhead.—It has been decided to add to the renewals fund of the tramway department the whole of the profits from the undertaking for the year ended March 31st, 1913.

Black Country.—With the object of averting a strike the directors of the various electric traction companies operating in this district—including the South Staffordshire Tramways (Lessee) Co., Ltd.; Dudley, Stourbridge and District Electric Traction Co., Ltd.; Wolverhampton District Electric Tramways, Ltd., and Birmingham and District Power and Traction Co., Ltd.—have had posted in the depôts of the companies official notices authorising alterations and additions to be made to the terms offered to the men as set out in the notices of May 15th and 21st. The new terms came into operation on Saturday last.

Burnley.—The annual report of the Tramways Committee states that the year ended March 31st last has been the most successful on record in every respect. The number of passengers carried was 15,949,359, an increase of 1,481,128 on the previous year. The total revenue was £79,890, an increase of £7,181; working expenses amounted to £49,430, an increase of £3,975. The sum of £5,791 has been placed to the reserve fund, and £8,750 has been allocated to the borough fund out of the profits.

Croydon.—The Tramways Committee has under consideration the question of extending the tramways from Norwood to Addiscombe.

Dewsbury.—The Electricity and Tramways Committee has decided to sanction the proposals of the Dewsbury, Ossett and Soothill Nether Tramways Co. for the extension of double lines of rails, and application is being made to the L.G.B. for sanction to borrow £1,000 for this purpose.

Dover.—Our contemporary, the *Kentish Express*, draws the attention of the T.C. to what, if correctly described, must be a most extraordinary state of affairs in connection with the local tramway track. Thus we gather that on the Folkestone Road "there were no less than four pieces of the line missing, the lengths varying from a yard to a foot." A further reference, this time to Snargate Street, states that "three pieces of rail about a yard long were missing." Is it possible that our contemporary viewed the scene in the pale morning light—when repairs are sometimes carried out?

Glasgow.—This week the final adjustment of the balance-sheet in connection with the Glasgow Corporation's tramway department, for the year ending May 31st, was submitted to, and approved by, the Committee. The figures showed that the surplus over the year's working accounts to be handed over to the Common Good—a general fund which holds a lien upon the undertaking—was £33,003, as compared with £52,067 for the preceding year, and £68,678 for the year 1910-11. A number of factors contributed to the decreased surplus. These included the following increases in expenditure:—Wages of motormen and conductors, £6,190; wages of cleaners, £3,145; local rates, £7,615; maintenance of track, £17,207; fuel for Pinkston, £2,826; interest on capital, £6,681; sinking fund, £3,214; and renewal and depreciation, £2,053—a total of £48,931. On the revenue side the ordinary receipts showed an increase of £20,468, and the interest on investments an increase of £8,859—a total increase of £29,327. Deducting this from the excess of expenditure, the balance is a sum of a little over £19,000, which represents a shortage in the surplus as compared with the surplus of the preceding year. As already reported in the REVIEW, the traffic receipts exceeded £1,000,000 sterling; they amounted, in fact, to £1,007,652, a circumstance largely attributable to the working of the extended ½d. stage. The total working expenses were £619,346; the balance carried to net revenue account was £392,196; this, with interest on investments, made a total of £450,827, from which are deducted rent of lines, capital charges, renewals and depreciation (£215,756), leaving the net surplus mentioned above.

Hove.—In connection with the trolley 'bus question, the General Purposes Committee of the T.C., after considering a detailed report on the inspection of the systems of railless electric traction established in Bradford and Leeds, has decided that as the proposals for the trolley 'bus system through Brighton and Hove were made in reliance upon licences being granted for the use of double-deck cars; and as the non-granting of such licences might seriously affect the success of the scheme, it is of opinion that before the Hove Corporation expends the large sum required for the installation of the trolley 'bus system, it should be ascertained whether such licences will be granted, and that, if not, an opportunity should be afforded for reconsideration of the joint system to be adopted on the through routes. Also that it would be more satisfactory to the Hove Council if the original proposal of the Brighton Corporation to test the system in the first place upon a portion of the route only were carried out.

Kirkcaldy.—The returns of the year's working of the tramways show a profit of £1,370, as compared with £1,351 for the previous year.

Leeds.—Various developments are contemplated by the tramway authorities. The Tramways and Electricity Committee recently recommended an application for powers for tramway and railless traction extensions, but the Parliamentary Committee decided that it was inexpedient to attempt to promote a Bill in Parliament in the next session, and recommended the Tramways Committee to consider only extensions for which powers could be obtained by prov. order. This will limit extensions for the time being to within the city boundary, and will not include those beyond that limit which were thrown out of the Bill now before Parliament, by a ratepayers' meeting last January. It is understood that 25 new cars are to be constructed in Leeds, and about a similar number are to be purchased elsewhere. Halfpenny fares are to be instituted on the Headingley, Chapeltown and Roundhay routes—the only routes which have not yet tried this system; the experimental trial of fare collecting on the platform is to be extended throughout the system, a six months' trial on all routes being given before finally adopting this arrangement.

Liverpool.—The Tramways and Electricity Committee has been instructed by the City Council to consider the practicability of utilising the tramway system for the conveyance of goods to neighbouring towns. Mr. P. D. Holt, who brought the proposal forward, said he thought that at least the experiment could be made at very little cost. Sir Charles Petrie did not oppose the motion, but pointed out that some few years ago the Corporation sought the co-operation of neighbouring towns for dealing with goods in this way. The unfortunate part of the business was that Bootle would under no circumstances allow them to draw goods traffic through the streets, and without the outlet at the north end they could not go on with the scheme, and the matter had to be dropped from the Parliamentary Bill.

Sheffield.—According to the statement of accounts the total expenditure of the tramway undertaking for the year ended March 31st last (including motor-buses) amounted to £207,689, or an average cost per car-mile run of 6·17d., compared with 6·11d. in the previous year. Against this total there was an income from both cars and buses of £362,127, leaving a gross profit for the 12 months of £154,303. After providing for various charges, interests, &c., there remains a balance of £77,296, which represents an increase of £8,561 over the previous year. This balance is to be appropriated as follows:—Street improvements, proportion of service of debt, £7,631; renewals fund (including interest on investment and bank interest), £30,186; special purposes fund, £2,000; accumulated surplus fund, £7,244; transfer to general district rate, £30,234. The amount to be transferred to the tramway renewals fund, &c., is to be increased from £30,000 to £35,000 per annum.

South Shields.—At a meeting of the T.C., on the 4th inst., Ald. Wylie moved the adoption of the annual report on the tramways for the past 12 months, and congratulated the Council on the success that had attended the system. The Committee's suggestion was that £500 should be paid to the insurance fund and the balance should go to the depreciation fund, and he said that it was essential that there should be a substantial reserve fund. Ald. Redhead moved an amendment to the effect that £1,600 of the profits should go to the relief of the rates. He pointed out that with the addition of the £4,217 that would be left, the reserve fund would amount to about £20,000, which he suggested was adequate. The amendment was, after long discussion, carried.

Torquay.—The T.C. has instructed the borough surveyor to make inquiries of certain towns were cliff lifts are installed, and to communicate with the makers, and report thereon. This has reference to the proposed cliff railway at Babbacombe.

Warrington.—The net profit on the working of the tramways, for the year ended March last, is £3,320, of which £1,500 has been handed over towards the relief of the rates.

Wolverhampton.—The annual report of the Tramways Committee for the year ended March 31st, on the working of the Corporation Tramways, shows there has been a gross profit for the year on electric traction account of £24,232. To this sum should be added the balance of £306 on motor char-a-banc account, representing a total of £24,538, which has been disposed of in the following manner:—Interest on capital, £6,964; income-tax, £100; repayment of loans, £5,146. To the renewals account, £3,809; additions and improvements, £1,105. On account of extensions at car depôt, 1913-14, £3,636; borough rate, 1913-14, £3,777. The sum of £50,220 now stands to the credit of the reserve and renewals fund. The traffic receipts for the year, the Committee states, have been highly satisfactory, and constitute a record in the history of the undertaking. The earnings have averaged over £1,000 per week. The total working costs per car-mile are 6·27d., or an increase of ·05d. per car-mile over last year's figure. Taking into consideration the extra cost of material, as well as the concessions made to the employés during the year, this figure is considered quite satisfactory. With reference to the Fallings Park Motor Char-a-banc Account, the Committee considers the result satisfactory. The working costs, including depreciation, amount to 8·107d. per mile, which is a very favourable figure for operating motor bus services.

TELEGRAPH and TELEPHONE NOTES.

A Bedstead Antenna.—Mr. A. A. Campbell-Swinton, who recently discovered that various metal fittings in his house gave out telephonic vibrations, has continued his domestic investigations, and writes to *Nature* of June 5th to say that he finds that an iron bedstead with wire mattress on the top (fourth) floor of the house answers quite well as an antenna for the receipt of wireless signals. It is only necessary to connect the receiving apparatus, which includes a Brown relay, between the bedstead and the water-pipe to receive the Admiralty signals loudly, and others from various unidentified stations faintly but quite audibly. He finds, also, that with the bedstead antenna it is possible to get the time signals from the Eiffel Tower. The signals are not very loud, but are sufficiently audible to be recognised and read easily.

For a portable station we suggest that it may yet be possible to use an umbrella, connected to the nails in one's boots, thus approaching a step nearer to the vest-pocket apparatus foreshadowed, we believe, by Prof. Ayrton.

Australia.—Recent tests in Melbourne show that out of 338 calls from subscribers' premises, 80 per cent. were answered within 10 seconds; only 17 took over half a minute. Apparently, therefore, a marked improvement in the service has been effected.

Tenders involving an expenditure of £90,172 have been accepted by the Minister of Home Affairs for material to be used in the construction of a telegraph line along the route of the Kalgoorlie to Port Augusta Railway. The greater portion of the amount is for the purchase of tubular iron poles and copper wire.

Brazil.—Government wireless stations are to be erected at Rio de Janeiro, Bauru and Porto Murtinho, by Marconi's Wireless Telegraph Co.

These stations will enable communication to be established with the base of the Matto Grosso Squadron. Another station at Santa Martha will communicate with ships south of the Republic. The report of the Minister of Marine states that the naval wireless telegraph stations have worked with unfailing regularity. New Marconi stations have been purchased, and the good results obtained justify the adoption of the Marconi system in the Brazilian Navy.

Cables and Trawlers.—An international conference has been sitting in London since Thursday last week, to consider what steps can be taken to protect submarine cables from damage due to trawling.

China.—The Republican Government has appointed Mr. Nakayama Ryuji, an engineer attached to the Japanese Department of Communications, as Adviser of Telegraphs and Telephones in the Chinese Department of Communications.

Formosa.—It is reported that the Formosan Government is considering the question of laying a submarine cable between the Island of Formosa and Hong-Kong.

Imperial Wireless System.—On Thursday last week, the Select Committee on the Marconi Contract examined Mr. F. S. Salaman, trustee of the estate of Mr. C. E. Fenner, a stockbroker, who appears to have absconded. His evidence showed that the Master of Elibank, who purchased 1,000 American Marconi shares from Sir Rufus Isaacs, also purchased 3,000 American shares through Mr. Fenner—2,500 on April 18th at 3¼, and 500 on May 14th, 1912, at 2 7/16. On Monday Mr. Percy Illingworth, Chief Government Whip, stated that he was informed on May 31st that Lord Murray (the Master of Elibank) had purchased these shares on behalf of the Liberal Party, while as Chief Whip he had sole control of the funds, but the shares had not been handed over to him. His name was associated with that of Lord Murray as co-trustee, but he had no knowledge of the purchase until the end of May. The chairman stated that Lord Murray in April, in answer to a telegram, replied that he could not return before July to give evidence before the Committee, owing to his business engagements. On Tuesday, Captain Murray, brother of Lord Murray, informed the Committee that the shares were left in his possession by Lord Murray, who said he had purchased them on behalf of the party, but proposed to keep them until the Marconi business was cleared up, so that nobody should be involved but himself. The Committee afterwards proceeded to consider the interim report.

On Wednesday a telegram from Lord Murray was read, stating that he had had no dealings in Marconi shares other than those mentioned above. He would make a sworn statement, or would return at once if the Committee desired it.

It is understood that the Committee on Wednesday rejected the chairman's draft report, and adopted a report declaring that Ministerial dealings in American shares did not concern the Committee.

Libel Action.—The result of the action brought by Mr. Godfrey Isaacs against Mr. C. Chesterton for criminal libel was that the defendant was found guilty and was fined £100 and costs. In passing sentence Mr. Justice Phillimore commented very severely on the cruelty of the charges, which, he said, were largely due to ignorance and prejudice on the part of the defendant.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—VICTORIA.—June 24th. H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" May 23rd.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" June 6th.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

July 22nd.—Telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 29th.—Detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

South Australia.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

Belgium.—June 18th. The municipal authorities of Liége are inviting tenders for a large quantity of armoured cables required in connection with the electric lighting undertaking in the city. Particulars can be obtained from the Bureau des Adjudications (Annexe de l'Hotel de Ville), Liége.

The Belgian Telegraph authorities in Brussels have just issued a notice to the effect that early in August next they will be inviting tenders for the supply and laying of underground cables between Brussels and Antwerp, and between Ans and Verviers. Those interested in the matter are invited to at once commence their inquiries as to the requirements, particulars of which may be obtained from the 2me. Direction Technique des Telegraphes, Hotel Centrale des Postes et des Telegraphes (Ier Etage, Local No. 32), Place de la Monnaie, Brussels.

Carlisle.—June 23rd. (*a*) Extensions to coal storage and conveying plant; (*b*) extensions to steam and water piping, for the City Electricity Department. F. W. Purse, City Electrical Engineer, Victoria Viaduct.

Eccles.—June 16th. Electricity Supply Committee. Coal and coke for 12 months. Borough Electrical Engineer, Cawdor Street, Patricroft.

Elland.—July 2nd. Street lighting lanterns, for the U.D.C. See "Official Notices" to-day.

France.—The municipal authorities of Foix, in the Pyrenees, are about to invite tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Paris.—June 16th. The Administration des Chemins de Fer de l'Etat are prepared to receive tenders for two batteries of electric accumulators for the Garenne-Bezons lighting and power sub-station. Particulars from the Bureaux du Service Electrique, 1re Division, 43, Rue de Rome, Paris.

June 20th. Tenders are invited by the State Railway Administration for electric machinery equipment of the Meudon-Val Fleury traction sub-station. Particulars from the Bureaux du Service Electrique, 2me Division, 43, Rue de Rome, Paris.

Versailles.—Shortly. The Conseil Général de Seine-et-Oise have decided to call for tenders for a concession for the establishment and working of a line of electric tramways from the station at Enghien to Ermont-Eaubonne, passing through Soisy, Audilly, Margency, Montlignon and Eaubonne. Particulars from and tenders to M. Monet, ingenieur en chef des Ponts et Chausées, 2 bis, Rue Colbert, Versailles.

Germany.—Bremen.—The plans drawn up for increasing the accommodation at the port of Bremen contemplate the outlay of £260,000, part of which is allotted for electric grain loading and unloading appliances, electric cranes, and the erection of a power house. Particulars from the Deputation für Häfen und Eisenbahnen, Bremen.

Leyton.—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" to-day.

Limerick.—July 3rd. Switchboard and gallery, battery, motor-driven booster, balancer, &c., for the County Borough Council. See "Official Notices" to-day.

London.—L.C.C.—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" June 6th.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" June 6th.

July 2nd.—Electrical installation at the Caldecot Road Elementary School, Denmark Hill, Camberwell (192 lighting points). See "Official Notices" to-day.

The Fire Brigade Committee is inviting tenders from selected firms for a motor-generator and switchboard for electric charging apparatus for use at the new Hammersmith fire station.

Hammersmith.—June 18th. Air-cooled static transformers, for the Borough Council. See "Official Notices" June 6th.

Stepney.—The Electricity Committee invites tenders for two E.H.T. converting plants suitable for 6,000-volt three-phase A.C. to L.T., D.C., for Limehouse and Whitechapel stations. See "Official Notices" to-day.

June 30th. Arc lamp carbons, for a year, for the Borough Council. See "Official Notices" to-day.

Newcastle-under-Lyme.—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" June 6th.

Newport (Mon.).—July 1st. Refuse destructor for the T.C. Borough Engineer Town Hall.

Rochdale.—Cable. Mr. C. C. Atchison, Electricity Works, Dane Street.

Rotherham.—Annual supply of coal to the Electricity Department; also stores for the Tramway Department.

Salford.—June 23rd. 4,000 steel tie-bars, for the Tramways Committee. General Manager, 32, Blackfriars Street.

Servia.—Belgrade.—Tenders are required for the supply of telephone apparatus and instruments—226 wall telephones à batterie commune, 200 portable and 200 table telephones.

South Africa.—Cape Town.—July 4th. High-tension switchgear, feeder pillars and three-phase transformers, for the Corporation. Particulars from the City Electrical Engineer on payment of deposit of £1 1s. per section (three sections).

Southampton.—June 19th. Electric lighting of the old pavilions at the Infirmary, Shirley Warren. See "Official Notices" May 30th.

Spain.—The municipal authorities of Aldeamayor (province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of four years.

Madrid.—July 7th. The Minister of the Marine has been authorised to acquire, by way of public tender, from foreign manufacturers, two wireless stations of great range for installation on board the cruisers *Estramadura* and *Rio de la Plata*; also of two others for erection in the naval school.

Sweden.—June 16th. Tenders are invited by the Swedish State Railways Administration for the supply of (1) 206,700 arc lamp carbons, and (2) 44,100 electric incandescent lamps. Tenders, marked "Anbud a baglampskol" in the case of (1) and "Anbud a glödlampor" in the case of (2), to "Kungliga Järnvägsstyrelsens Förradsbyra," Stockholm, whence copies of the specifications and forms of tender may be obtained. Copies of the specifications and forms of tender (in Swedish) may be seen by manufacturers in the United Kingdom at the Commercial Intelligence Branch of the B. of T.

Swindon.—June 23rd. Cooling tower, water softening plant and flanged cast-iron piping, for the Electricity Department. See "Official Notices" June 6th.

Torquay.—The Electrical Engineer has been instructed to prepare a specification for illuminating the Pavilion and Gardens, and to invite local tenders for carrying out the work.

West Hartlepool.—June 14th. Two 300-kw. rotary converters, complete with transformers, switchgear, &c., for the Corporation. See "Official Notices" May 30th.

CLOSED.

Aysgarth.—The B. of G. has accepted the tender of Messrs. Burton, of Askrigg, for installing the electric light at the Workhouse.

Belgium.—Eight concerns—two Belgian and six German—submitted tenders last week to the municipal authorities of Schaerbeek for the establishment of a low-tension network in connection with the municipal electricity supply undertaking. The lowest offer was that of the Société des Ateliers de Constructions Electriques, of Charleroi.

Bolton.—The Electricity Committee has accepted the tender of the Electrical Apparatus Co., Ltd., for the supply of 3 and 5-amp. direct-current meters.

Bradford.—Messrs. Roberts & Co., Ltd., whose tender had been recommended for acceptance for steelwork for workshop extensions at Thornbury tramway depôt, withdrew their tender, owing to an alleged clerical error therein, and the Tramways Committee has decided to accept in lieu thereof, the tender of Messrs. Henry Barrett & Sons for the execution of the work, at £1,230.

The tender of Messrs. Beecroft & Wightman, Ltd., has been accepted, at £265, for a supply of hardwood paving blocks to the Tramways Department; also that of Messrs. John Brown and Co., Ltd., at £350, for 200 steel tramcar tires; that of Messrs. Collier Bros., at £408, for 4 miles of 0000 grooved copper trolley wire.

The following tenders for electric lighting at schools have been accepted by the Education Authority:—

Belle Vue Boys' Secondary School.—R. Crust, £222.
Deaf and Cripple School.—R. Crust, £206.

The Corporation Libraries and Arts Committee has accepted the tender of Messrs. A. Ridgway & Co. for the installation of electric light at Manchester Road Branch Library, for £57, and at Girlington Branch Library, for £65.

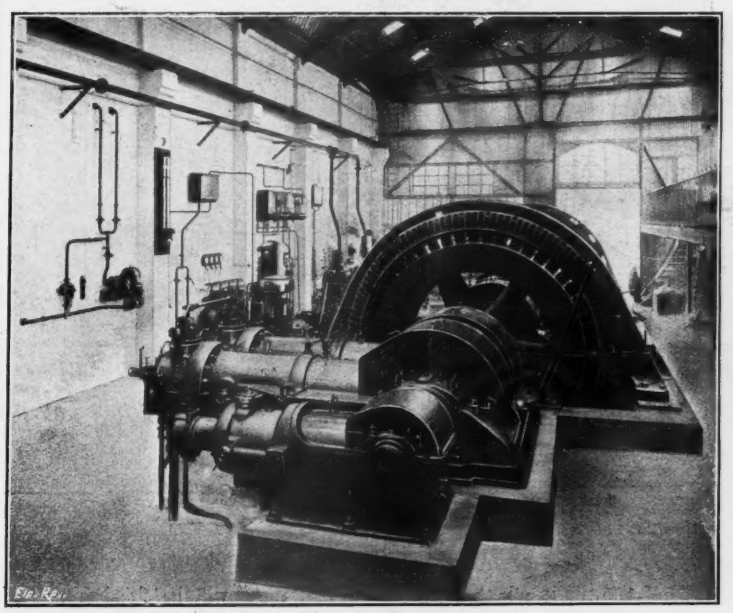
Burton-upon-Trent.—The Gas and Electricity Committee has accepted the tender of Messrs. Salisbury & Wood for supplying 1,000 tons of fine slack to the electricity works.

(*Continued on page* 989.)

NEW DIESEL PLANT AT KINGSTON-ON-THAMES.

ALTHOUGH the official programme of the Municipal Electrical Convention makes no mention of the new Diesel generating plant which is just being completed at the Kingston-on-Thames Electricity Works, yet we do not doubt that amongst the numerous visitors to the riverside borough on Thursday next, many will take the opportunity of inspecting this plant, which is practically the first of its kind to be installed in this country, being of the horizontal type.

Two Diesel-engine units have been installed, one being of the four-cycle and the other of the two-cycle type; each is coupled to a 270-KW. Siemens alternator of the fly-wheel type, the contract for the complete plant having been entrusted to the Maschinenfabrik Augsburg-Nürnberg A.G., whose reputation for Diesel engines is of the highest.

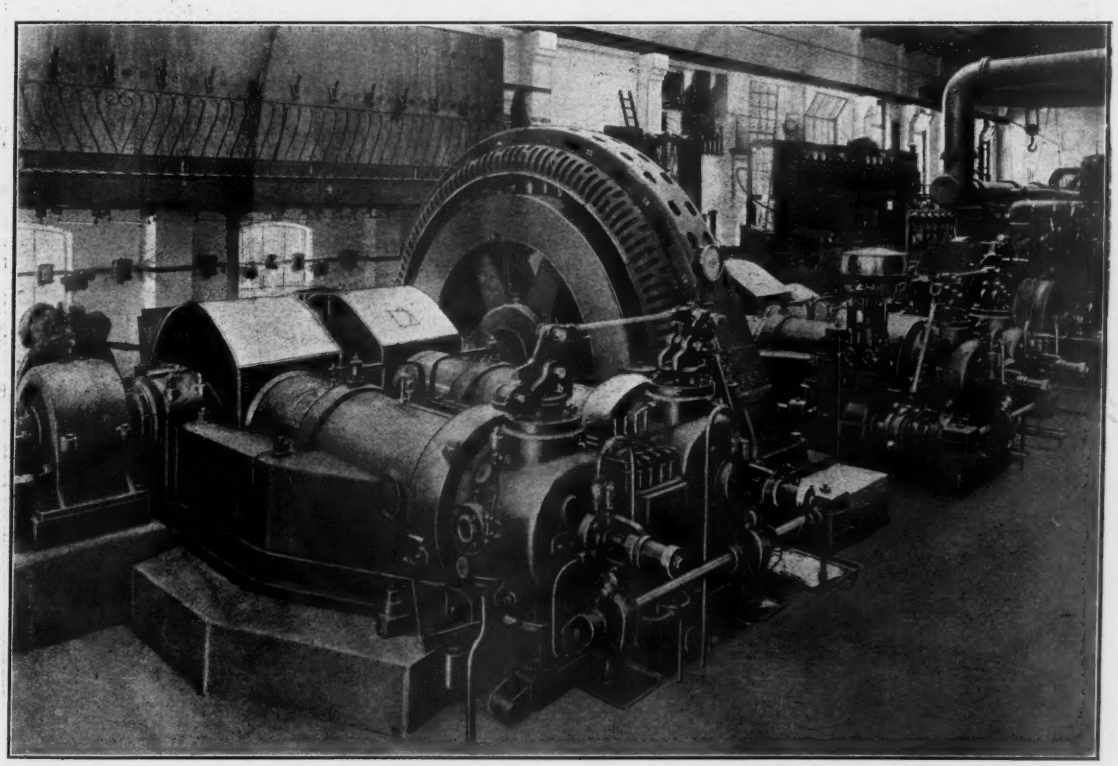


HORIZONTAL 4-CYCLE, 4-CYLINDER DIESEL ENGINE, KINGSTON-ON-THAMES; COMPRESSOR END.

house. Mr. J. E. Edgcome, the borough electrical engineer, therefore decided to have one four-cycle set with the lowest possible fuel consumption to take the whole load of the station for an average of 16 hours a day, and to shut down the boilers entirely during such hours.

Further, in order to obviate the risk of stoppage, it was decided to be less costly to install another Diesel set rather than to keep the necessary boilers banked during the day. This second set, in addition to its stand-by duties, will assist the steam plant on peak loads, and the less costly, though slightly less efficient, two-cycle engine was selected as the best for the purpose.

The views on this page are of the four-cylinder four-cycle engine, rated at 400 B.H.P., with a speed of 192 R.P.M. The alternator, to generate 2,100 volts, 77 cycles, single-phase current, is placed between the pairs of cylinders;



HORIZONTAL 4-CYCLE, 4-CYLINDER DIESEL ENGINE, SHOWING CYLINDER HEADS, VALVE GEAR, &C., KINGSTON-ON-THAMES ELECTRICITY WORKS.

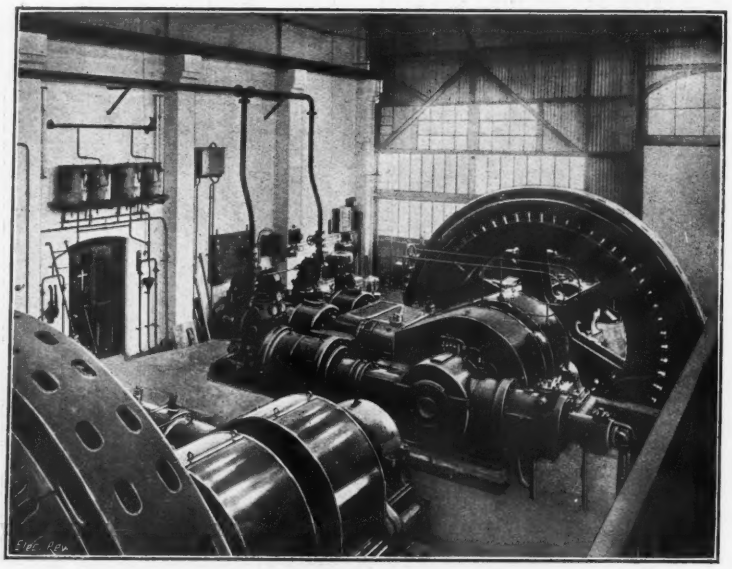
When the engines were ordered it was the intention to decrease both fuel costs and wages and repairs in the boiler a 110-volt exciter is mounted on one extremity of the crank-shaft and a direct-driven air compressor on the other.

G

The engine is all enclosed, and one governor controls the oil pumps for all the cylinders; the fuel injection valves are situated behind the cylinder heads, the air inlet valves on the top, and the exhaust valves underneath.

The air for combustion purposes is drawn through pipes from the crank chambers, entering the covers through small inspection doors. This arrangement not only provides for cooling the crank chambers themselves, but it also sucks into the cylinders oily fumes which would otherwise escape into the engine-room, and, moreover, is very silent in operation.

The valves and oil pumps are worked by small eccentrics on a lay shaft worm geared to the crankshaft.

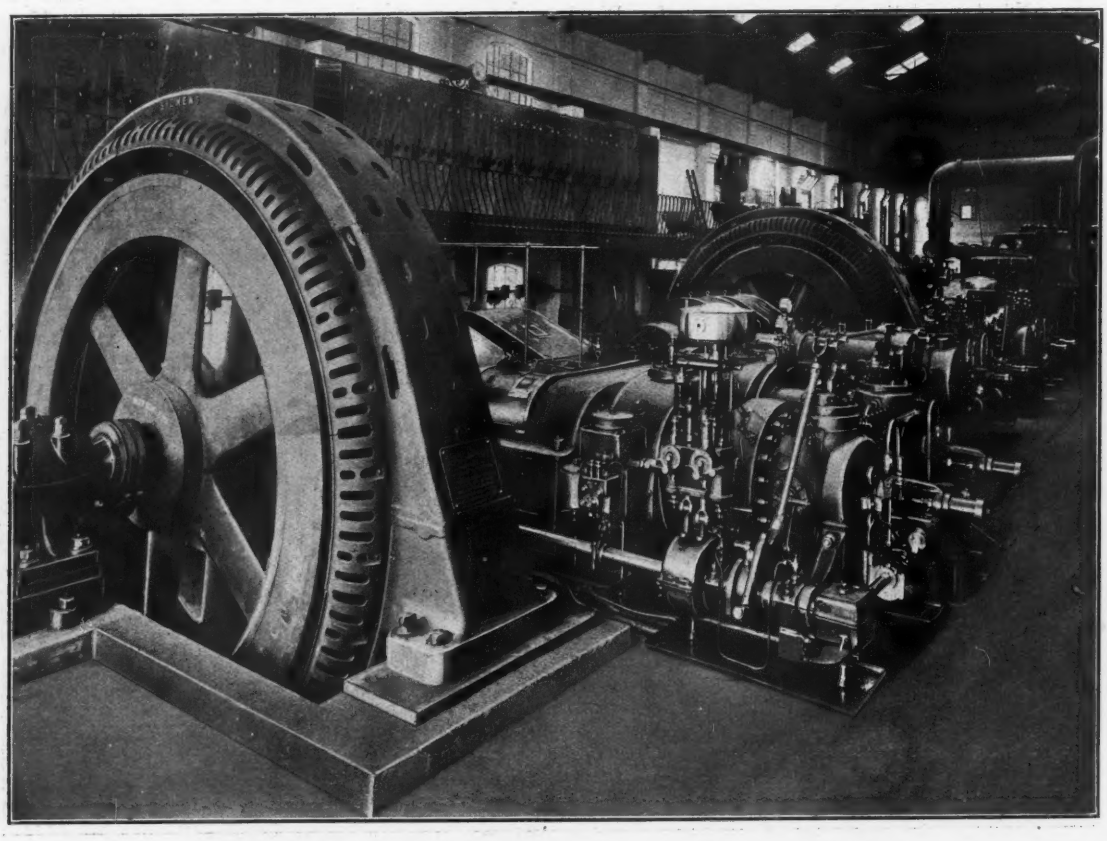


Horizontal 2-Cycle, 2-Cylinder Diesel Engine Set, Kingston-on-Thames Electricity Works.

The two-cycle two-cylinder engine, also rated normally at 400 B.H.P., has a speed of 165 R.P.M.; both alternator and exciter are mounted on one side, while at the other end of the crankshaft are a direct-driven compressor and scavenging pump facing each other on opposite sides of the shaft. In this engine the pistons are water cooled. The cooling water system is of interest; river water is pumped, by means of small motor-driven centrifugal pumps, into an overhead 5,000-gallon tank, and from this flows by gravity through the compressed air intercooler, the cylinder jackets of the air compressors, the working cylinder jackets and cylinder heads in both engines, back to the river. For the piston cooling of the two-cycle set, however, small electrically-driven plunger pumps are installed to force the water through the pistons. Duplicate pumps are installed in each case, but only one is normally in use. Both the compressors are provided with intercoolers between H. and L.P. stages; two starting and two injection bottles are provided which are cross-connected to both engines.

A central lubricating and oil-filtering plant is provided, and both gravity and forced lubrication are adopted in the engines.

Two 60-ton fuel storage tanks have been installed in the boiler house, and these will be filled from tank barges in the Thames, 200 yards distant, by electrically-driven pumps, and will contain sufficient fuel to provide for average day and night load running of the 4-cycle engine for 20 weeks. From these tanks a small electrically-driven pump (with a stand-by hand pump) lifts the fuel oil into a service tank, which is subdivided to serve for both tar oil and crude oil residues, which latter is the so-called ignition oil when working with tar oil. From the service tank the fuel gravitates through filters to



General View showing the New Diesel Plant at Kingston-on-Thames.

the main fuel pumps, and smaller "ignition" oil pumps, which are provided to each cylinder, the former being governor controlled. The guaranteed fuel consumption of the 4-cycle engine on normal load is ·41 lb. per B.H.P.-hour, and of the 2-cycle engine about 10 per cent. more.

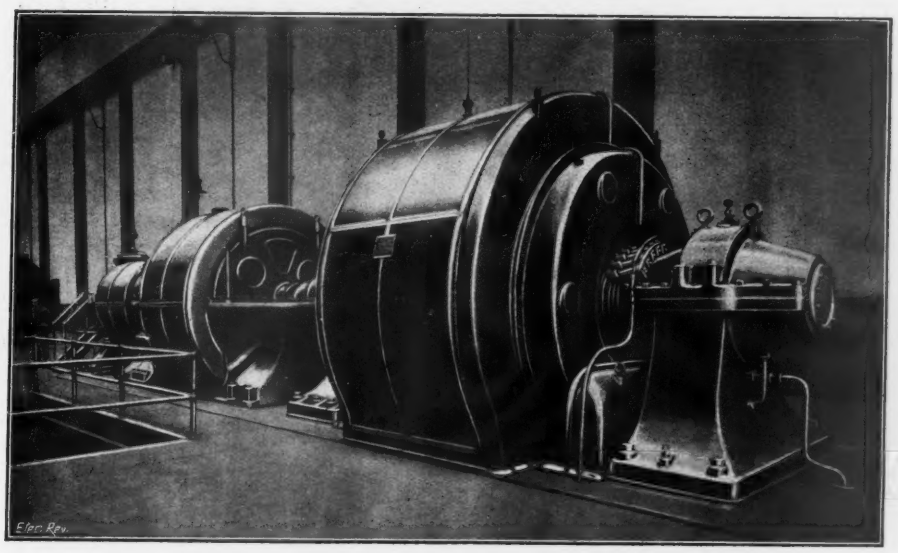
In view of the high price of ordinary oil fuel, Mr. Edgcome proposes to use water-gas tar as a fuel, its cost being considerably less, and the engines being adapted for using either water-gas tar or coal tar oil in place of the normal oil fuel.

The two-cycle engine has a considerable overload capacity, equivalent to 25 per cent. for two hours.

As the horizontal Diesel engine will, no doubt, be viewed with critical eyes in this country, it may be worth while to point out its good features. These are mainly concerned with accessibility. It is possible to withdraw the piston from the crank end and without interfering with the cylinder head, which, necessary in the case of the vertical engine, means disturbing all the pipe connections. The whole of the valves are within easy reach, and more likely to receive regular supervision, and dismantling is a somewhat easier operation.

The cylinder heads are fitted underneath with blow-off valves which are opened every time the engine stops, allowing the deposit and grit to be blown into the exhaust piping, and incidentally enabling the pistons to be kept at work a much longer period than when this cannot be done. The makers claim a good many other advantages in addition to the above.

In conclusion, we are indebted to Mr. Edgcome for facilitating the preparation of this short description.



5,500—6,000-KW. PARSONS-WESTINGHOUSE TURBINE SET AT THE CHELSEA POWER STATION OF THE LONDON UNDERGROUND RAILWAYS.

THE CHELSEA RAILWAY POWER STATION.

THE Chelsea power station of the London Underground Railways system, at Lot's Road, which will be visited by the Municipal Electrical Association during the forthcoming Convention, has long been a feature of electrical London, its size, constructional features, and the services which it is called on to render being matters of considerable interest to the engineering fraternity. The plant, which was very fully described and illustrated in our columns when first opened,* supplies three-phase current at 11,000 volts, 33⅓ cycles, for transmission to rotary sub-stations on the routes of the Metropolitan District, with its connecting lines to Barking and *viâ* the recently-electrified East London Railway to New Cross, the Piccadilly, Bakerloo, and Charing Cross-Hampstead tubes, and the Kingston-Wimbledon sections of the London United Tramways. The accompanying views give a good idea of the modern Parsons-Westinghouse turbo-alternator plant installed in this station, the eight sets each having a normal rating of 5,500-6,000 KW.

GENERAL VIEW OF THE ENGINE ROOM, CHELSEA RAILWAY POWER STATION.

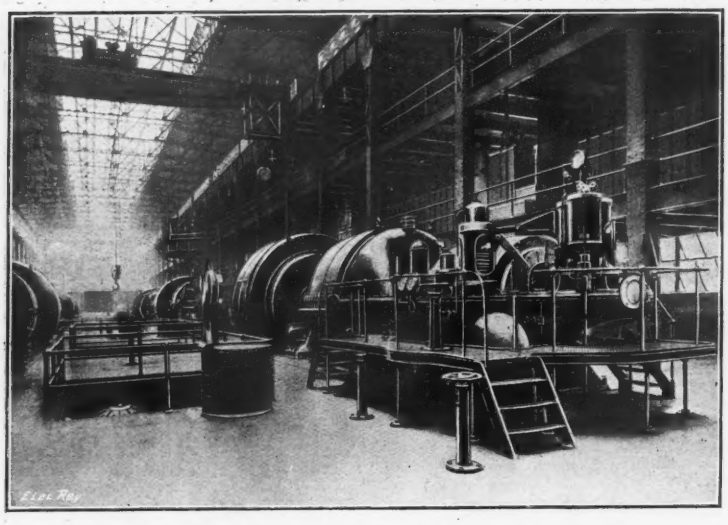
These turbines exhaust into vertical condensers situated in a deep central pit running the length of the engine room between the lines of turbines; the circulating water is drawn in through strainers and 66-in. pipes from the river Thames.

Each turbine consists of separate high and low-pressure sections, coupled through a steam chest below floor level. Solid forged steel H.P. rotors and built-up L.P. rotors are

* See ELECTRICAL REVIEW, June 9th and 16th, 1905.

fitted, while each section has its own thrust-block adjustment allowing of finer clearances being used in the H.P. sections.

Steam at 185 lb. pressure, superheated 150°, is admitted through a Ferranti-Hopkinson valve at the high-pressure end, into a steam chest which carries an emergency stop valve—automatically controlled by an auxiliary governor—the main governor-controlled stop valve and an automatic by-pass valve, spring controlled, which admits live steam to a second group of blades on the H.P. rotor, and thus enables the turbine to quickly follow sudden changes of load, such as may occur in a plant of this kind.



THE CHELSEA (LOT'S ROAD) RAILWAY POWER STATION.

The turbines were, of course, built to suit existing foundations and to drive existing alternators (speed 1,000 R.P.M., efficiency 95 per cent.) and the steam consumption is 14 lb. per KW.-hour, with a 28-in. vacuum. The normal rating, as already mentioned, of the machines is 5,500-6,000 KW., but we gather that they periodically work up to 9,000 KW. or more.

According to report, it is intended to install a 15,000-KW. turbine unit at no distant date.

This turbine plant is supplied with steam by 64 Babcock boilers, arranged on two floors and equipped with economisers, chain-grate stokers, superheaters, &c. A very complete coaling plant is installed for filling the bunkers, of 15,000-tons capacity, from a barge basin on the river side, the coal being mostly water borne.

The chimneys, four in number, 19 ft. diameter internally and 275 ft. high, are familiar landmarks for miles round—indeed, their symmetrical arrangement on the boiler house, two and two, together with the projecting conveyor trunk at the end of the building, has led some people not unmindful of the American features of the plant, to liken the station to a gigantic teddy bear upside down.

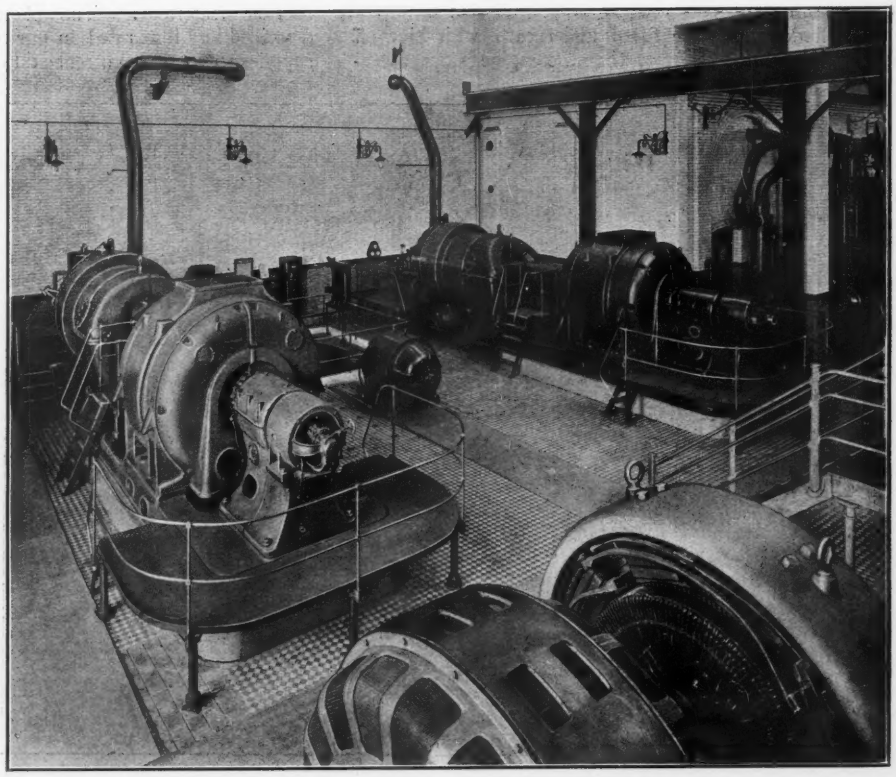
The H.T. switchgear, as shown in our view, is arranged on three galleries running along one side of the spacious engine house, while the auxiliary switchgear is installed on galleries at one end of the building. This was all supplied by the B.T.H. Co.

A feature of the station is the oil-cooling plant for a total capacity of 20,000 gallons; the station output amounts to about 150 million units per annum.

NEW TURBINE PLANT AT POPLAR.

ON Friday last we were privileged spectators at the official inauguration of the extensions recently carried out at the Poplar Borough Council's generating station at Bow. Prior to the actual starting up of the machinery, the assembled guests were welcomed outside by Councillor H. R. Barge, chairman of the Electricity Committee; Mr. Horace Bowden, the borough electrical engineer, briefly described the features of interest of the new plant, while the Mayor (Councillor Aldrick), Ald. Bussey, and several others also spoke.

Though the showery weather somewhat damped the municipal eloquence which one naturally associates with an occasion of this sort, the new turbine sets subsequently got to work in a most businesslike manner, and the visitors were then free to explore the works.



3,000-KW. WILLANS G.E.C. TURBINE SETS INSTALLED AT THE POPLAR ELECTRICITY WORKS EXTENSION.

The Borough Council's electricity undertaking was originally started in 1899, Mr. A. S. Blackman being responsible for the scheme, which was for direct-current supply; its limitations led in 1904-5 to the introduction of three-

phase alternating-current supply of 6,000 volts pressure, in connection with sub-stations which were established in the Isle of Dogs and near Victoria Park, and which contain motor-converting plant for the supply of direct-current at 460 volts. The last extensions which have now been brought into use add some 6,000 KW. of three-phase plant to the Council's resources, and in view of the fact that the output last year rose to 12,000,000 units, from 9,500,000 units in the previous year, it will be seen that this plant is a very necessary addition. Briefly, large additions have been made to the boiler and engine houses, the area occupied being some 8,000 sq. ft. The new boiler house is designed to accommodate four large boilers, of which two have been installed, together with a 400-ton coal bunker, ash hoppers, conveying plant, feed pumps, &c.

The boilers are of the Babcock marine type, each normally rated at 36,000 lb. per hour evaporative capacity, with a maximum of 41,500 lb.; each has a heating surface of 6,295 sq. ft., and an integral superheater of 1,108 sq. ft. One is fitted with two underfeed stokers giving 154 sq. ft. grate area, an air heater in the uptake to the steel chimney and a fan for driving the air through the furnaces; the other boiler has two modern Babcock chain grates, giving 224 sq. ft. grate area, and a Babcock feed-water heater below the chimney, which is equipped with the Prat induced draught. Both chimneys stand 91 ft. high above firing level. The boilers are designed for 200 lb. working pressure, but actually supply steam at 185 lb., and the two typical equipments provided, have, we understand, given some interesting comparative data, which as regards steaming power was apparently much in favour of the boiler equipped with the Prat draught system and chain grate stoker.

The coal conveyor has a capacity of 40 tons an hour, and together with an ash hoist, was supplied by the New Conveyor Co. Messrs. Weir supplied a "Rotofeed" turbine-driven single-stage feed pump, for delivering 10,000 gallons per hour, in which the steam consumption at full load is 60 lb. per W.H.P. per hour; a Boby Simplex continuous automatic water softener has been provided, which stands over a 14,000-gallon storage tank. The reagents used with this softener are distributed to the water in powder form.

The engine room plant, which we illustrate, consists primarily of two 3,000-KW. Willans-G.E.C. turbo-alternators, but a 1,000-KW. Peebles motor-converter, and a 1,000-KW. Westinghouse rotary together with switchgear by the Westinghouse Co., have also been installed.

The turbines are of the disk and drum type, with an overload capacity of 50 per cent. for half an hour and 25 per cent. for three hours; the guaranteed steam consumption is as follows:—

Load ...	5/4	4/4	3/4	2/4	1/4
Lb. steam ...	13·8	13·7	14·4	15·7	19·7 net

Steam pressure 180 lb., superheat 150°, and vacuum 28½ in.; with the higher steam pressure possible, correspondingly lower consumption figures would be obtained. The alternators are excellently finished machines, turned out at the Witton Works of the General Electric Co., and have the following guaranteed efficiencies:—

Load ...	5/4	4/4	3/4	2/4	1/4
Efficiency ...	94 %	93 %	92 %	89½ %	83 %

Each machine weighs, complete, 38 tons, and has an exciter mounted on an extension of the main shaft.

The Willans condensing plant is of normal type, arranged under the turbines, with triple crank single acting air pumps, direct-driven at 125 R.P.M. by 30-B.H.P. B.T.H. motors; the air pump discharges are measured by Lea recorders.

The circulating water for this plant is obtained from an adjacent canal, where a pumping plant has been installed 210 ft. distant from the engine room. The plant consists of three Rees Roturbo vertical spindle circulating pumps, each to deliver 4,800 gallons of water per min., when running at 625 R.P.M., and coupled to Peebles 100-B.H.P. motors. At full load the pump efficiency, W.H.P./B.H.P., is 80 per cent.

The pumps draw from a settling chamber where the water passes through C.I. screens; it is interesting to record that during the reconnection of the circulating water piping, which took 36 hours, the load of the station was taken up by the adjoining Stepney undertaking, in order to avoid running non-condensing, thus proving the emergency value of the electrical linking up of the two concerns, which was originally engineered in 1908.

To return to the engine-room plant, both the Peebles motor-converter and Westinghouse rotary converter are rated at 1,000 KW., and installed for converting 6,000-6,500-volt alternating current to 470-540-volt direct current.

The former has guaranteed efficiencies of 92¼ per cent., 91½ per cent. and 90 per cent. at full, three-quarter and half load respectively, these figures comparing with 94½ per cent., 93½ per cent. and 91½ per cent. overall efficiencies (including transformer) guaranteed for similar loadings in the case of rotary plant.

The Westinghouse rotary is a 12-pole compound-wound machine running at 500 R.P.M. (as against 375 R.P.M. in the case of the motor-converter), and is supplied with six-phase 350-volt current from an oil-insulated self-cooled transformer situated in the basement below the switchboard.

The business end of the new switchgear is placed in a disused battery room behind the switch gallery. The switches have a normal breaking capacity of 9,000 KW., and an emergency capacity of 18,000 KW.; the Stepney link, of 1,500-KW. capacity, is protected by Merz-Price relays and transformers, and the new engine room is spanned by a Royce 30-ton electric travelling crane. The extensions have been carried out by Mr. Horace Bowden, the borough electrical engineer, to whom we offer our congratulations.

CONTRACTS CLOSED.

(*Concluded from page* 984.)

Canterbury.—The T.C. has accepted the tender of Mr. R. E. Connold, Canterbury, for electrical work for the ensuing half-year.

Cheltenham.—The T.C. has accepted the following tenders:—

Ferranti, Ltd., and British Westinghouse Co., Ltd.—Electricity meters.
Geipel & Co.—Arc lamp carbons.
Webster & Co.—Flame carbons.
E. Le Bas & Co.—Cast-iron pipes for new condensing plant, £65.

Cleckheaton (Yorks).—The tender of Messrs. F. W. Birkett & Sons, Ltd., has been accepted for the electric light installation at Whitcliffe Road Wesleyan Church.

Croydon.—The T.C. has accepted the tender of Messrs. Newbold & Co., of Sutton, for electric lighting installation at the fire station, at £216 10s., and at the Library, at £129 10s.

Devonport.—The Electric Power Committee of the T.C. has accepted the tender of Messrs. A. J. Smith & Co., of Bristol, for 6,000 tons of coal, at £1 0s. 2d. per ton.

Doncaster.—The Corporation Electricity Committee has considered tenders for generating plant for the electricity works, and recommended that the tender of Messrs. Siemens for the alternator be accepted, and that the order for the turbine and condenser be placed with Messrs. Willans & Robinson, Ltd., or Messrs. J. Howden & Co. These recommendations have been adopted by the Council, who agreed to leave the decision in the latter matter to the chairman and vice-chairman on the receipt of further particulars from the engineer.

The T.C. has accepted the tender of the Lancashire Dynamo Co., Ltd., for a dynamo, at £168.

Dover.—The T.C. has accepted the tender of the Featherstone Colliery Co. for coal for the electricity works, at 17s. per ton.

Dundee.—The offer of Messrs. Babcock & Wilcox, Ltd., at £2,510, for steam, feed and drain piping, &c, have been accepted by the Electricity Committee.

France.—The French Post and Telegraph authorities in Paris last week placed contracts as follows:—

La Société des Ateliers de Constructions du Nord et de l'Est, of Jeumont (Nord).—100 km. of single-conductor lead-covered telephone conductor; 80 km. ditto, with two conductors; 25 km. ditto, with seven pairs of conductors; 125 km., with two conductors.
La Société des Trefileries du Havre.—50 km. ditto, with single conductor; 40 km. ditto, with two conductors; 25 km. ditto, with seven pairs of conductors; and 125 km. ditto, with two conductors.

Glasgow.—The following contracts have been accepted by the T.C. Tramways Committee:—

Steel rails and fishplates.—Bolckow, Vaughan & Co., Ltd.
Lighting fittings.—Drake & Gorham, Ltd.

In connection with additional plant for Pinkston power station, offers have been opened for a 5,000-KW. turbo-alternator, and the estimate of the British Thomson-Houston Co. has been accepted.

Haslingden.—Mr. A. M. Cramp, of Haslingden, has secured the contract for the electric lighting and electric organ-blowing plant at the Trinity Baptist Chapel and Schools, Blackburn Road; also the order for an electric light and power and vacuum cleaning plant at Carr Hall, the residence of Mr. J. Lambert, and at "Knowl Gap," the residence of Councillor A. Bailey.

Liverpool.—A further order for 4,000 Robertson lamps has been secured from the Corporation by the General Electric Co., Ltd. We understand that these lamps have been specially ordered for the purpose of illuminating a certain part of the city in honour of the forthcoming visit of the King.

London.—L.C.C.—The Fire Brigade Committee received the following tenders for an electric lighting installation for the new fire station at Hammersmith :—

A. Hawkins & Sons	(recommended)	£205
Pinching & Walton		218
W. C. Tackley & Co., Ltd.		238
Electrical Contracts and Maintenance Co., Ltd. ..		282

Engineer's estimate, £200

The "Cedes" Electric Traction, Ltd., which recently received a contract for the supply of a petrol-electric motor chassis for converting a turntable ladder for motor traction, has been in communication with the Committee, as the result of which the Committee has rescinded its resolutions on the matter. It expresses the opinion now that an electrically-driven chassis would probably be more suitable than a petrol-electric one for the purpose.

In connection with the alterations required to the parapet lanterns on Westminster Bridge in connection with the conversion of the existing arc lighting to metallic-filament lighting, the following tenders were received :—

S. Pontifex & Co.	(accepted)	£72
John Biggs		150
W. Sugg & Co., Ltd.		216

HACKNEY.—The Electricity Committee recommends that the tender of Messrs. W. Cory & Sons, Ltd., for Cowdenbeath, Edinburgh and Hillhouse coals for nine months to March next, be accepted.

POPLAR.—The Electricity Committee recently reported that, in order to cope with the estimated demand, it was necessary that the order should now be placed for the remaining two boilers to equip the station. The firm price of £9,975 for the supply and erection of two boilers exactly similar to No. 10 boiler, already installed, had been obtained from Messrs. Babcock & Wilcox. Boiler shops were extremely busy, and any delay by advertising for and considering tenders would render it impossible to complete the installation next winter, whereas Messrs. Babcock & Wilcox promised completion in January next. In addition to the boilers, it would be necessary to obtain prices for the steam, feed and blow-down piping, and also for one additional ash hoist. The Committee recommended the acceptance of the offer of Messrs. Babcock & Wilcox, and this the Council agreed to.

The B.C. has received the following tenders for the supply of a 1,000-KW. converter at the Millwall sub-station :—

Siemens Bros. Dynamo Works Co, Ltd.		£2,185
General Electric Co., Ltd.		2,196
Bruce Peebles & Co., Ltd.	(recommended)	2,285
Vickers, Ltd.		2,473
British Westinghouse Co.		2,507
British Thomson-Houston Co.		2,516
Dick, Kerr & Co., Ltd.		2,618

The Electricity Committee states that, in view of the small difference in price (£100) between the tender of Messrs. Bruce Peebles and Co., whose converters are already in successful operation in the Council's stations, and the lowest tender, it would be advantageous to the Council that such tender for a motor converter, identical with that supplied last year, should be accepted, and it has been decided accordingly.

Manchester.—The following tenders have been recommended for acceptance by the Corporation Electricity Committee :—

E. Green & Son, Ltd.—Replacement of No. 3 economiser.
S. P. Bidder & Co.—Repairs to chimney and exhaust pipe.
General Electric Co., Ltd.—Two 50-H.P. three-phase motors.
Aiton & Co.—L.P. steam and water pipes.
Siemens Bros. Dynamo Works Co., Ltd.—Switchgear, bus-bars, &c.
Holden & Brook, Ltd.—One electrically-driven boiler feed pump.
Sturtevant Engineering Co., Ltd.—Air filtration plant.
De Bergue & Co., Ltd.—Steelwork for foundations of 15,000-KW. turbo-generator.
Bruce Peebles & Co., Ltd.—Two 750-KW. motor converters.
British Electric Transformer Co., Ltd.—Requirements of 75-K.V.A. transformers.
W. T. Henley's Telegraph Works Co., Ltd.—L.T. cable and paper-insulated cable.
Electrical Engineering and Equipment Co., Ltd.—L.T. cable.
Charles Macintosh & Co., Ltd.—Rubber-insulated cable.

The Corporation Tramways Committee has recommended the following tenders for acceptance :—

Drake & Gorham, Ltd.—Traction type incandescent lamps.
Estler Bros.—Canopy trolley standards.
Bolckow, Vaughan & Co., Ltd.—Steel fishplates.
Bayliss, Jones & Bayliss, Ltd.—Steel tie bars.

Rochdale.—The Corporation is recommended to accept the tenders of the Vulcan Pump and Engine Co. and Messrs. Marshall, Osborn & Co. for the supply of boiler feed pumps for the electricity works.

Salford.—The tender of Mr. Bertram Thomas for copper strip required for the main lighting and power switchboard at the electricity station, at £302, has been recommended for acceptance by the Electricity Committee.

Stoke-on-Trent.—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for feeder cables, at £500,

Sheffield.—The tenders of the Tinsley Park Colliery Co., Ltd., and Messrs. M. L. Burnby & Son have been accepted for an annual supply of washed coal to the Kelham Island power station, at 13s. 6d. per ton, and 13s. 2½d. and 13s. 5d. per ton respectively. For the erection of a building to house the new rotary converting plant at the Kelham Island power station, the tender of Messrs. W. & A. Forsdike, Ltd., has been accepted, at £3,210.

Sunderland.—The T.C. on Wednesday accepted the following tenders :—

Sturtevant Engineering Co.—Air filter for new alternator.
A.E.G. Co., Berlin.—Short-circuiting device for new alternator, also spare parts for alternator.
Dick, Kerr & Co., Ltd.—Spare parts for alternator.
Phœnix Dynamo Co.—Re-insulating one 750-KW. alternator.
J. Thompson & Co.—1,500 yd. wood troughing.
B.I. and Helsby Cables, Ltd.—4,000 yd. L.T. cable: 500 yd. E.H.T. cable.
Crewdson & Hardy.—1,250 yd. w.i. piping and bends.

Tonbridge.—The U.D.C. has accepted the tender of :—

Mirrlees, Bickerton & Day, for additional plant for the electricity works, £1,884.
Western Electric Co.—Cables.

Walsall.—The Corporation has accepted the tender of the British Westinghouse Co., Ltd., for a 100-KW. rotary converter at the Sandwell Street sub-station, including station transformer and other accessories, for £636, and for the erection of a high-tension feeder at the generating station, at £70 10s.

The tender of the Electrical Power Storage Co., Ltd., has been accepted by the T.C., at £26, for renewing the storage batteries at three stations. The price quoted is subject to an allowance of £12 10s. per ton for all old plates removed.

Wimbledon.—The tender of Messrs. E. Foster & Co. has been accepted by the T.C. for an annual supply of about 4,000 tons of Kingsbury Rider small nuts coal to the electricity works, at 17s. 10d. per ton.

Wolverhampton.—The Corporation has accepted the following tenders :—

Amies & Sharratt.—Additions to the electricity stores, £728.
Davies Bros. & Co., Ltd.—Materials required in the construction of safety guides for the bucket conveyor, £55.
Vaughan & Sons.—One 5-ton and one 3-ton overhead travelling cranes, £105.
Electric Construction Co., Ltd.—Direct-current switchgear for the converter plant, £172.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, June 13th. At Blackpool. Annual Conference concludes.

Physical Society.—Friday, June 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments on Tinfoil Contact with Dielectrics," by Mr. G. E. Bairsto. Paper on "A Method of Measuring the Pressure of Light by Means of Metal Foil," by Mr. G. D. West.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 14th. At 2 p.m. At the Wood Memorial Hall, Newcastle-upon-Tyne. General meeting.

Municipal Electrical Association.—Eighteenth Annual Convention.
Tuesday, June 17th.—At 10 a.m. At the I.E.E., London. Opening by Mr. W. Duddell, F.R.S. Address of Mr. C. E. C. Shawfield. Paper on "Prime Movers for Electric Power," by Dr. S. Z. de Ferranti. At 2.30 p.m. —Leave for visits to Deptford power station and West Ham electricity works.
Wednesday, June 18th.—At 10 a.m. Discussion *in camera* (members and delegates only). Subjects :—(1) The I.M.E.A. Bill; (2) Heating and Cooking. At 2.30 p.m.—Leave for visit to Lot's Road power station, Chelsea. At 7 p.m.—Annual dinner at the Hotel Cecil (members, visitors and ladies).
Thursday, June 19th.—At 10.15 a.m. Meeting in the Empire Theatre, Kingston-upon-Thames. Address of welcome by the Mayor. Papers on "Air Filtration," by Mr. J. Christie, and "Electric Vehicles," by Messrs. W. H. L. Watson and R. J. Mitchell. Demonstration following. At 1.30 p.m.—Luncheon at Nuthalls, Ltd. At 3 p.m.—River trip. At 7.30 p.m. —Dinner at Nuthalls, Ltd.
Friday, June 20th.—At 10 a.m. At the I.E.E. Annual general meeting.
Saturday, June 21st.—At 9.30 a.m. Leave for visit to Chingford reservoir.

Electrical Contractors' Association.—Tuesday, June 17th. Annual dinner at Frascati's.

Institution of Electrical Engineers (Scottish Section).—Tuesday, June 17th. Annual summer outing to Inversnaid.

Royal Society of Arts.—Tuesday, June 17th. At 9 p.m. At the Natural History Museum, South Kensington, S.W. Conversazione and reception by Lord Sanderson.

Chemical Society.—Thursday, June 19th. At 8.30 p.m. Ordinary meeting.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, June 16th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 5th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m. Leaf Cup competition will take place on miniature range, commencing at 7 p.m.

Tuesday, June 17th.—"B" Company. Ditto. Advance party for Bere Island parade at Headquarters at 12 noon.

Thursday, June 19th.—"C" Company. As for 16th inst.

Friday, June 20th.—"D" Company. As for 16th inst.

Saturday, June 21st.—Main body for Bere Island parade at Headquarters at 12 noon. Headquarters will be opened for the transaction of regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Wanted—Three Hundred Pounds.—We are pleased to be able to make two additions to the list of donors of £100 who desire to enable the Electrical Trades Benevolent Institution to take advantage of Mr. E. G. Byng's offer. Mr. Justus Eck, who has just returned to these shores from a lengthy tour in the Colonies, made it one of his first duties to communicate to the secretary his wish to co-operate to the full in this matter. Mr. Eck has done for this fund right from its very beginning more than many people can ever know, and he again shows the sincerity and zeal with which he regards his offspring by putting his name in the accompanying list. Mr. Dane Sinclair has also generously forwarded to us personally a cheque for £100, which we have handed on to the secretary. The deep concern with which Mr. Sinclair has noted our continued appeals for the fund, and his great desire to prevent the movement being unsuccessful, will appear from the following letter which accompanied his donation :—

"Dear Mr. Gatehouse.—Considering the best interests of the electrical fraternity in this country, I have been sorry to see that it has been necessary for the REVIEW to ask so often for the total of £1,000 to be subscribed to the Electrical Trades Benevolent Fund, and had hoped to see what one might term the more wealthy members coming forward and doing the necessary; but the time-limit is now approaching, and I should be sorry to see this good cause falling through for lack of funds, and have therefore pleasure in enclosing my cheque for £100 I shall be glad if you will add my name to the list of those who have already subscribed, and I trust that this week will see the full amount raised.

"I think the thanks of everyone are due to you for the trouble your paper has taken in this matter.—Yours faithfully,

"DANE SINCLAIR.

"*June 10th*, 1913."

Three spaces still remain open, and once again we renew our appeal to the large-hearted to 'phone or write to the secretary, or to us, under the first impulse that possesses them after reading this note. The position now stands as follows :—

1	Mr. E. G. Byng	£100
2	Mr. G. Sutton	£100
3	Mr. H. Hirst	£100
4	Mr. E. Garcke	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	£100
6	Mr. Justus Eck	£100
7	Mr. Dane Sinclair	£100
8	*	
9	*	
10	*	

It has been suggested that, as all the donations down to date are from individuals, the company contributions are long overdue. But then it takes longer to get a proposal passed by a board of directors than for a private gentleman to settle the matter with his own heart and conscience. After all, "company" proposals generally have an individual origin. We hope that both boards and private individuals will speedily find the remaining three hundreds.

Foreign Trade in May.—The returns published this week show that during the month of May imports advanced by 11·2 per cent. (nearly 6¼ million sterling), exports by 12·9 per cent. (over 5 million sterling), while re-exports fell by 13·4 per cent. (nearly 1½ million sterling). The electrical and machinery figures for the month, and for the five months, are as follows :—

Imports.	*Month of May 1913.*	*Inc. or dec.*	*Five months 1913.*	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and insulated wire ...	118,723	+18,576	624,868	−6,091
Machinery	650,362	−18,623	3,162,493	+278,970
Exports.				
Electrical goods and apparatus, excluding machinery and insulated wire ...	465,072	+163,595	2,381,357	+636,603
Machinery	3,255,976	+496,550	15,190,633	+2,060,971

Tramway Appeal in the Lords.—At the time of going to press, the appeal in the case of the Tottenham Urban District Council *v.* the Metropolitan Electric Tramways, Ltd., is being heard in the House of Lords.

Lead Prices.—The agreement as to lead quotations recently arranged by Hamburg manufacturers has now been extended to the whole of Germany under the following conditions :—The basis price for leaden articles is raised 1·50 marks per 100 kilog., the sale prices being as follows :—For the Rhineland and Westphalia, freight basis of Cologne, 45·10 marks; for South Germany, 45 marks, freight basis of Mannheim, Mayence and Strassburg; for Middle Germany, 44·50 marks, freight basis of Hanover and Hamburg; for Brandenburg, 44·50 marks, freight basis of Brandenburg; for Berlin, 40·50 to 43·50 marks, freight basis of Berlin—all per 100 kilog., payable within 14 days, with 1½ per cent. discount.

Meeting of London Electrical and other Workers.—We are informed that a meeting of electrical workers was held at Caxton Hall on June 2nd, under the chairmanship of Mr. George Dew, L.C.C., the Secretary of the London Building Industries Federation, who hoped that that splendid gathering was an augury for a brighter future for the electricians of the Metropolis. Mr. Jack Potter, the district secretary, moved a resolution pledging the meeting to support the efforts of the London District Committee to secure an advance of wages and better working conditions for those engaged in the industry. He stated that some of the employers were making a very definite attempt to reduce the wages of the wiremen—a miserable 9½d. per hour. They were approaching the London County Council and the Government departments to get the schedule rates reduced, and unless the men put up a strenuous fight, they would go down. He appealed to the audience to go into the highways and imbue their fellows with the spirit of solidarity, so that they could stand shoulder to shoulder with the workers of other industries, to create a social order where poverty and low wages would be impossible. Mr. H. Rolf, of the Electrical Trades Union, seconded the resolution. Other speakers were : Mr. Ben Tillett, Mr. James Macdonald, the late secretary of the London Trades Council, and Mr. Jack Kinniburgh, the organiser of the E.T.U., who said it was a disgrace to the electricians that they were not yet on the move. The E.T.U. had raised wages in all industrial centres; London alone had not moved, but he hoped that that meeting would inspire them with the determination not to rest until they had secured more of the good things of this life. Mr. Harry Adams, of the Bricklayers' Society, promised the support of their members in whatever efforts were made, and Mr. Hugo Beazley, the organiser of the Plasterers' Union, thanked the electricians for the splendid support they had rendered the plasterers in their dispute with the master builders. A speech, urging the necessity of combination among all workers, from Mr. Fred Knee, the secretary of the London Trades Council, concluded the meeting, which, we are informed, carried the resolution unanimously.

London Railway Contracts.—The *Financial Times* stated last Saturday that the contract for electrifying a portion of the London and South-Western Railway at a cost of just under £300,000 had been given to the British Westinghouse Electric and Manufacturing Co. "The order, it is stated, is the largest single one of its kind ever handed out, and the British Westinghouse Co. is to be congratulated on having secured it on terms, it is to be presumed, which will keep its plant profitably employed for a considerable period. The contract of a similar nature of the London and North-Western, involving a sum of £160,000, has gone to the Oerlikon Co., of Zurich. Great disappointment is felt in engineering circles that a British firm has failed to obtain this order, and private conferences are being held to discuss the causes of the unsuccessful tendering of home manufacturers. The two contracts alluded to do not include power stations, the details of which have not yet been settled, but relate solely to railway equipment."

Our contemporary added in its Monday issue :—"The contract for the construction of the necessary power houses has still to be awarded, and in engineering circles it is generally believed that this work also will be given to the British Westinghouse. The sum involved will be large, precisely how much cannot be stated, but probably over £200,000, and the contract will naturally be greatly sought after. Doubtless, however, the successful tenderers will come to terms with the rest of the trade, it being customary among the big engineering interests to sub-let portions of works of the magnitude of these railway electrification schemes."

The *Railway Times* says that the Oerlikon contract is for the electrical equipment of over 40 trains. We understand that the contracts for the boilers and rotary converters for the L. & S. W. Railway have also been given out.

Association of Electrical Station Engineers.—A meeting was held at Birmingham on June 10th, at which Mr. McKee was in the chair, and a branch was definitely formed for the Midlands. Mr. E. A. Gordon was elected hon. secretary, and representatives from Worcester, Birmingham, Walsall, Wednesbury and West Bromwich were elected on the Committee. The hon. secretary was elected delegate for the Conference, and the meeting passed a few resolutions, which the delegate was instructed to put before the Conference. A similar meeting was held recently at Liverpool, when Mr. A. C. Black was elected delegate for the Conference. The date of the general meeting of the whole Association has been fixed for June 24th, to be held at Chandos Hall, Maiden Lane, W.C.

Contracts and Fair Wages.—In the House of Commons questions, Mr. O'Grady asked the First Lord of the Admiralty whether he was aware that the firms of Spagnoletti, Ltd., Shepherd's Bush; Johnson & Phillips, Charlton, Kent; Keith and Blackman, Holloway Road; and Messrs. Crompton, Chelmsford, contractors to the department, paid instrument makers in their employ wages ranging from 7d. to 8d. per hour, the standard rate being 9d., and also employed a very large amount of boy labour on similar work at rates ranging from 2d. to 4d. an hour, thus enabling these firms to compete unfairly with firms employing adult labour; and whether he would make inquiry into the matter with a view to enforcing the provisions of the Fair Wages Clause. Dr. Macnamara replied that he was not aware of the circumstances referred to, but would have inquiries made. He might add that the Trade Union had recently instanced one of the firms named in the question as being a firm who paid 9d. per hour.

Electricity Supply Rifle League.—The following matches were decided during May:—Hackney (Smith 95), 550; Westminster (Winchombe, Herley 98), 567. Hackney (Hilling 96), 559; Shoreditch (East 99), 570. Shoreditch (Weeks 100), 578; Ilford (R. Tufnall 97), 556. St. James's (Green, Young 93), 521; Ilford (R. Tufnell, McKelvey 95), 553. Central (Law 97), 564; Westminster (Partridge 99), 576. Central (Rhodes 98), 575; Poplar (Mogg 93), 490. St. James's (Strange 98), 567; Stepney (Heaviside 96), 539. Stepney (Barber 98), 556; Brompton (Mugford 96), 559. Poplar, 507; St. James's (Hocking 96), 547.

The following are the positions to date:—

	Shot.	*Won.*	*Lost.*	*Points.*	*For.*	*Against.*
Shoreditch ...	6	6	0	12	3,441	3,278
Westminster ...	6	5	1	10	3,414	3,302
Ilford	6	5	1	10	3,383	3,210
Central	6	3	3	6	3,369	3,284
St. James's ...	6	3	3	6	3,196	3,265
Brompton ...	5	2	3	4	2,778	2,767
Stepney	6	1	5	2	3,256	3,190
Hackney ...	6	1	5	2	3,221	3,259
Poplar	5	0	5	0	2,264	2,767

The Dumfries-London Electric Vehicle Trial.—We understand that the 380-mile trial run of the Arrol Johnson-Edison battery vehicle, to which reference was made last week, terminated successfully on Wednesday. No electrical, mechanical or tire troubles were experienced; but due to adverse weather, and the limited maximum speed of the vehicle, which is fitted with a nominal 3½-H.P. series motor, the run took rather longer than intended. It is, however, stated to be the first time that such a long run has been carried out by an electrical car in Europe.

Annual Outings.—For their annual outing on June 4th, the staff of the Guildford Electricity Supply Co., Ltd., went for a trip to Portsmouth. They were accompanied by Mr. H. L. Alderton, engineer and manager, and Mr. R. Harold Piper, secretary and accountant, together with several guests. Luncheon was served at Scullard's Victoria Hotel, Southsea, and later, trips were made to the Isle of Wight and other places in the vicinity of Portsmouth. In the evening the party were present at the Portsmouth Hippodrome.

Institution and Lecture Notes. — ASSOCIATION OF MINING ELECTRICAL ENGINEERS—EAST OF SCOTLAND BRANCH.—At the annual meeting of the branch held at Dunfermline, Mr. C. A. Carlow, of the Fife Coal Co., who has been the president of the branch since its inception three years ago, resigned, and Mr. H. G. Fraser, Leven, chief electrician to the Fife Coal Co., was nominated for the vacancy. Mr. R. W. Peters, electrician to the Lochgelly Iron and Coal Co. was appointed to the joint post of secretary and treasurer, and Mr. N. A. Wilkie, Cardenden, was elected as auditor. After the business meeting, the members were socially entertained by Mr. C. A. Carlow, the retiring president.

A meeting of the Association was held at Hednesford, on Saturday. Mr. A. Hall was unanimously re-elected president for the ensuing year; Messrs. C. F. Jackson, M. J. Moffeth, Chris Jones and J. R. English were elected vice-presidents. Mr. H. Arnoth was re-elected as secretary and treasurer. A discussion took place on Mr. Bolton Shaw's paper on "Notes on Colliery Generating."

VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the meeting of this Institute, held at Melbourne on May 1st, there was a discussion on the notes on his "Trip Abroad," read at a previous meeting by the hon. secretary, Mr. Westwood, and three 10-minute papers followed:—"Wire Drawing: A New Australian Industry," by J. K. McDougall; "Use of Aluminium Conductors," by G. B. Lincolne; "Fire Resisting Materials," by Noel Murray.

PHYSICAL SOCIETY OF LONDON.—At the meeting on May 16th a paper on "Some Experiments to Detect β-rays from Radium A," by Dr. W. Makower and Dr. S. Russ, was read by Dr. Russ. A paper on "Vibration Galvanometer Design," was read by Dr. Haworth. The author states that it is an advantage to be able to increase the useful power input per unit voltage. To do this the resistance of the instrument must be decreased. This can be done by leading the current in and out at the bottom bridge and short-circuiting the wires at the top bridge, and it results in a great increase of sensibility. At high frequencies the flux density required is large. In order to obtain this result economically it is convenient to make the depth of the poles small compared with the maximum length of the wires. The result is a very satisfactory instrument with a much flatter voltmeter-sensibility-frequency curve than obtained usually. Mr. W. Duddell remarked that if it was required to make a really efficient galvanometer for high frequencies it was best to redesign the whole instrument. When a very low resistance was wanted silver wires could be used. A strong field necessitated using an electromagnet, against which he had a prejudice, for vibration galvanometers. Mr. A. Campbell pointed out that in some cases it was current sensitivity that was required. This depended upon the bridge the galvanometer was used with.

At the meeting on May 30th, a paper on "Electro-thermal Phenomena at the Contact of Two Conductors with a Theory of a Class of Radio-Telegraph Detectors," was read by Dr. W. H. Eccles. The paper is a purely theoretical one, and deduces mathematically the laws connecting the current and the applied E.M.F. in a circuit containing a light contact of two conductors. The bulk of the wireless telegraphy of the world is carried on by such contacts as these, and the present paper, therefore, constitutes a theory of the action of these detectors. It is shown that, in general, when a contact is used as a radiotelegraph detector, there may be some coherer action mixed up with the thermoelectric "rectifying" action; and that, whether there is or is not any coherer action, the principal features of the characteristic curve connecting current and E.M.F. are determined by the Thomson rather than by the Peltier effect. Dr. J. A. Fleming communicated a statement to the effect that a large number of measurements of characteristic curves of his valves and other detectors had shown that there were sudden changes of curvature in them. The results did not, however, fall in with any very simple theory of such rectifying detectors.

INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).—The officers of the Students' Section for the session 1913-14 are as follows:—Chairman, Mr. S. M. Hills; vice-chairman, Mr. R. E. Dickinson; hon. secretary, Mr. E. T. Driver; hon. assistant secretary, Mr. R. A. McMahon.

NEWCASTLE LOCAL SECTION.—The report of the Committee for the session 1912-13 states that the total membership of the Section is 319, a decrease of two on last year's figure. The full members, associate members, associates and graduates have increased by 47, and the student members decreased by 49. The average attendance was 52. The Tees-side members have held several meetings in Middlesbrough, under the direction of a Local Sub-Committee. This activity has been much to the advantage of that district and also of the Institution, as its membership has thereby materially increased. There are now about 56 members in the Tees-side District. The Student Section has done good work, and two of the students have been awarded premiums for papers. The Committee has some prospect of concluding arrangements by which the members will be at liberty to attend the ordinary meetings of other Societies in exchange for similar privileges. The officers and Committee for the ensuing session are as follows:—Chairman, Mr. C. Vernier; vice-chairmen, Messrs. P. V. Hunter and J. H. Holmes; past chairmen, Messrs. C. Faraday Proctor, C. S. Vesey Brown and W. C. Mountain. Committee, Messrs. W. McLellan, R. P. Sloan, C. Turnbull, G. Stoney, A. H. Marshall, J. R. Andrews, Wm. Thornton, H. Stroud, J. R. M. Elliott, A. P. Pyne, G. L. Drury, J. A. Anderson, C. H. Davidson, and E. Fawssett. Hon. treasurer, Mr. W. A. Clatworthy; hon. secretary, Mr. H. W. Clothier; assistant hon. secretary, Mr. W. G. Guns; hon. auditors, Messrs. H. L. Riseley and F. O. Hunt.

The Committee of the NEWCASTLE STUDENTS' SECTION reports that the membership at the end of the session 1911-12 was 151. During the past year there have been 29 additions, but owing to the large number of removals and transfers the total has decreased to 102. It has been thought that the Committee of the Students' Section in London is officially in a somewhat false position. Recent correspondence suggests that the "London Students' Section" is to be so named, and that a satisfactory definition of the functions of the "London Students' Committee" has now been made. The Students' annual tour this year is to take the form of a visit to Newcastle from July 3rd to 5th. The officers for the new session are Messrs J. Hacking (chairman), E. Wyatt (vice-chairman), H. V. Henniker (hon. sec.).

IRON AND STEEL INSTITUTE.—The preliminary programme of the Brussels meeting, from September 1st to 4th, has been issued. A number of papers are to be read and discussed; Ghent Exhibition is to be visited; and there are to be excursions to Liége and Charleroi, where important works will be visited.

ILLUMINATING ENGINEERING SOCIETY.—The report of the Council for the session to May, 1913, refers to the effective co-operation of the Society with other bodies, and to its growing prestige on the Continent. Dr. R. T. Glazebrook has been nominated a Vice-President. The membership of the Society now exceeds 400. With the co-operation of the Society, a similar association has been formed in Germany, supported by the Reichsanstalt, and has made good progress. The finances of the Society are in a satisfactory condition.

Strikes.—The *Times* on Monday stated that the works of the General Electric Co. at Witton had been closed down for a week, the office staff taking a holiday. The firm were willing to concede the minimum wage, but would not consent to wipe off the debts which the employés had accumulated in connection with their work. The total amount of the debt was said to be at least £1,000, and the individual sums ranged from £3 to £50.

Appointments Vacant.—Assistant lecturer in electrical engineering, Manchester School of Technology (£200); sales engineer, for the York electricity department (£120); foreman electrician and electrical foreman, for locomotive workshop power house (Rs. 250 per mensem), for the South Indian Railway; mechanic and blacksmith, for the Watford U.D.C. (32s.). Twenty electrical fitters are wanted for H.M. Dockyard at Devonport (38s.); assistant superintendent for Sheffield installation and motor department (£150). See our advertisement pages to-day.

Batti-Wallah River Trip.—The motor-boat *St. George*, which took the Batti-Wallah party on their down-river trip, came to grief by colliding with some floating wreckage off the Ovens Buoy. One of her planks was knocked in and she sank in 7½ minutes. The engine kept going until half-submerged, assisted by the crew paddling with floor boards, &c., and the party reached shore in 4 ft. of water. We understand that interesting photographs will be exhibited to those forming the Up-River party on 28th inst.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On leaving the generating station, Gloucester, for a position in Canada, MR. T. H. MORRIS was presented by the chief engineer, on behalf of the staff and workmen of the department, with a suit case.

Our Cape Correspondent writes: "The town clerk of Port Elizabeth has received a cable stating that MR. H. J. HOLDER, the municipal electrical engineer, who is at present on leave in England, met with a serious accident, as a result of which he has been unconscious for a week. The cable stated that an operation had been successfully performed on the skull, but that a further operation might be necessary."

The Leek U.D.C. has increased the salary of MR. CARR, electrical engineer, by £25 a year.

The electric supply and tramway staff at Ipswich have presented an oxidised silver table standard lamp with silk shade, to MR. GEO. L. GARTON, who has charge of the installation department, on his marriage. From the wiremen, &c., of the installation department, Mr. Garton received a tea service.

MR. S. T. ALLEN, late city electrical engineer at Carlisle, on leaving to become electrical engineer at Wolverhampton, has been presented by the staff with a gold watch and oxidised silver inkstand.

The Elland U.D.C. has increased the salary of MR. WM. C. KNOWLES, chief electrical engineer, from £150 to £165 per annum.

MR. T. R. STANCOMBE has resigned his position of installation superintendent to the York Corporation Electricity Department, and has been appointed engineering representative for power purposes to the Bristol Corporation Electricity Department.

Tramway Officials.—The members of the Metropolitan Association of Electric Tramways Managers, are entertaining MR. H. E. BLAIN to dinner on Friday, the 4th prox., at the Municipal and County Club, Whitehall, on his resignation as tramways manager at West Ham, and also as Chairman of the Association.

General.—MR. JUSTUS ECK, whose departure we announced last October, has now returned to London, after many months spent in visiting Australia, Tasmania, New Zealand, Canada, and the United States, in the interests of the Union Electric Co., of Southwark. During his visit to Melbourne he read a paper on "Indirect Lighting by Arc Lamps," before the Victorian Institution of Electrical Engineers, and received an invitation from the Engineering Society of Queensland, to read a paper before that body. Unfortunately, lack of time compelled him to decline. Mr. Eck expresses himself satisfied in every way with his tour, and particularly with the cordial reception universally extended to him by members of all branches of the electrical industry.

Canada states that the HON. ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission, arrived in London last week.

MR. W. P. BURTON, who has been invited by Sir T. Lipton to command the new America Cup Challenger, is the vice-chairman of the Ipswich Electric Supply and Tramways Committee. He is also the Master of the East Suffolk Foxhounds and Master of the Staghounds.

MR. W. HAYES has resigned his position in the Supply Department of British Westinghouse Co., Ltd., Manchester, and has joined the staff of Messrs. Falk, Stadelmann & Co., Ltd., as outside representative for their new branch establishment, now open at 107-111, Shudehill, Manchester.

The marriage took place at St. Matthew's Church, East Croydon, on June 3rd, of MR. JOHN WM. HOLDRON, only son of the late Mr. John Holdron, of Holdron & Son, electrical engineers, of Market Street, Ashby-de-la-Zouch, and Miss Marguerita Pullen, youngest daughter of the late Mr. John Pullen, of East Croydon.

A marriage took place at St. Gabriel's Church, Cricklewood, London, on June 4th, of MR. ROBT. BARRON, electrical engineer, of Fleetwood, and Miss Winifred Baxter. Mr. and Mrs. Barron were the recipients of a large number of presents, including silver plate from the bridegroom's Fleetwood employés, and a clock from the members of the Fleetwood Canine Society, of which the bridegroom is hon. secretary.

MR. J. E. SPAGNOLETTI has severed his connection with the firm of Spagnoletti, Ltd.

DR. CARL HERING is at present in London from the States on a business trip.

MR. W. LEWIS has been presented with an illuminated address on his retirement from the secretaryship of the sick benefit society founded by the employés of Messrs. Spagnoletti, Ltd., Shepherd's Bush. Mr. John Griffiths made the presentation at a large gathering of the staff.

MR. M. N. JACKS, director of Messrs. Humphreys, Ltd,, and MR. J. NORMAN AMBLER, have joined the board of Scholey and Co., Ltd.

Obituary.—MR. J. W. COURTENAY.—We deeply regret to learn of the death, which occurred very suddenly at his residence at Stevenage, on Sunday, June 1st, of Mr. James Watts Courtenay. The deceased gentleman was better known to that section of our readers who are interested in tramway matters by reason of his being managing director of our esteemed contemporary, the *Tramway and Railway World*. For many years he carried on business as a tramway advertising contractor with branches in various cities, but in 1892 he associated himself with others in the establishment of the paper mentioned above, subsequently acquiring a controlling interest and becoming its managing director. The Tramway and Light Railway Exhibitions held some years ago at the Agricultural Hall, Islington, were mainly due to his enterprise and organising genius, and in other connections both the Municipal Tramways Association and the Tramways and Light Railways Association have paid a tribute to the useful services rendered by Mr. Courtenay to the tramway industry. For some years he had suffered from a heart affection, but he bore up under this burden with remarkable bravery. For years he had faced imminent death without the least complaint. Latterly, however, he had appeared to be in better health, and his death at the age of only 56 years, came as a shock to all. Those who were so long associated with him in the offices of our contemporary, will greatly miss a personal friend, for he was a man of exceptional charm to his intimates. To these we extend the sympathy of *confrères*. We understand that Mr. Courtenay's death will not entail any change in the policy or staff of the paper, and that his advertising business had recently been converted into a limited liability company, under the style of J. W. Courtenay, Ltd., and it will be continued as before.

A number of our readers will, we are sure, desire to associate themselves with us in expressing sympathy with Mr. W. S. Foale, engineer and manager of the Portsmouth Corporation electricity works, in his bereavement. His wife passed away on Monday last, after an illness of some weeks.

NEW COMPANIES REGISTERED.

Electrical Engineering and Motor Co. (Carlisle), Ltd. (129,213).—This company was registered on May 28th, with a capital of £3,000 in £1 shares, to carry on the business of automobile engineers and store and garage keepers, suppliers of electricity and other motive power for motors, motor-engines, motor-boats, flying machines, carriages, &c., and to adopt an agreement with C. Armstrong Lamb and W. R. Armstrong Lamb. The subscribers (with one share each) are:—C. Armstrong Lamb, Lowther Street, Carlisle, electrical engineer; W. R. A. Lamb, Lowther Street, Carlisle, electrical engineer; A. Castigbone, Lowther Street, Carlisle, motor engineer. Private company. The number of directors is not to be less than three or more than five; Armstrong Lamb is first managing director. Solicitors, E. and Kighley J. Hough, Carlisle. Registered by Morrison & Powell, 5, Raymond Buildings, Gray's Inn, W.C.

Beatson & Co., Ltd. (129,208).—This company was registered on May 28th, with a capital of £3,000 in £1 shares, to take over the business of an electrical engineer, carried on by H. Beatson at 14, Waingate, Sheffield, and 76, Frederick Street, Rotherham. The subscribers (with one share each) are:—H. Beatson, 5, Owlerton Green, Sheffield, electrical engineer; H. A. Holliday, 8, Park View Road, Sheffield, secretary. Private company. The number of directors is not to be less than two or more than five; the first are H. Beatson (permanent) and others to be appointed by the subscribers; qualification, £50; remuneration as fixed by the company. Solicitor, E. Aryton, 17, Bank Street, Sheffield. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Wireless Electric Light Co., Ltd. (129,284).—Registered May 30th, by H. G. Campion & Co., 23, Old Broad Street, E.C. Capital, £75,000 in 70,000 ordinary "A" shares of £1 each, and 100,000 ordinary "B" shares of 1s. each. Objects: To carry on the business of electric lighting and general engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c., and to adopt an agreement between O. Markiewicz, M. J. Stoeck, and R. H. Markiewicz of the one part, and J. L. Gilmore of the other part. The signatories (with one share each) are:—E. Wilding, 23, Mildmay Chambers, 7, Union Court, E.C., chartered accountant; J. L. Gilmore, 6, Broad Street Place, E.C., merchant; R. Lee, Belaugh, Woodmansterne Road, Purley, engineer; L. Perry, 16, Sunderland Terrace, Westbourne Gardens, W., engineer; E. R. Baines, Green Street Green, Orpington, accountant; W. B. Bannerman, 4, The Waldrens, Croydon, secretary; T. H. Browton, 23, Old Broad Street, E.C., clerk. Minimum cash subscription, 100 ordinary "A" shares. The first directors (to number not less than three or more than seven) are E. Wilding, J. L. Gilmore, and M. Stoeck. No qualification required till nine months after statutory meeting; afterwards £100 (managing director excepted); remuneration (except managing director), £200 each per annum (chairman, £250), and 2½ per cent. of the net profits, after 10 per cent. dividend is paid, divided between them. Registered office, 6, Broad Street Place, E.C.

Morris & Lister (London), Ltd. (129,269).—This company was registered on May 30th, with a capital of £3,000 in £1 shares, to carry on the business of agents for, and dealers in, electrical and engineering machinery and plant, electricians, engineers, suppliers of electricity, &c., and to adopt an agreement with Morris & Lister, Ltd. The subscribers (with one share each) are:—F. J. Bakewell, Northcliffe, St. Margaret's Bay, Dover, engineer; P. A. Lanbach, 26, West End Lane, West Hampstead, N.W. Private company. The number of directors is not to be less than two or more than three. the first are F. J. Bakewell and D. J. Morris. Registered office, 3 and 4, Palace Chambers, Bridge Street, Westminster.

W. E. L., Ltd. (129,282).—This company was registered on May 30th, with a capital of £2,000 in 1s. shares, to carry on the business of electric lighting and general electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, &c. The subscribers (with one share each) are:—J. L. Gilmore, 6, Broad Street Place, E.C., merchant; E. Wilding, 22, Mildmay Chambers, 7, Union Court, E.C., chartered accountant. Private company. The number of directors is not to be more than five; the first are not named; remuneration, £10 each per annum (chairman £15). Registered office, 6, Broad Street Place, E.C.

Magnetaire, Ltd. (129,366).—This company was registered on June 4th, with a capital of £100 in 1s. shares, to take over the business of therapeutists and manufacturers of and dealers in electrical and magnetic appliances carried on by W. Light and A. W. Light, as "Copson, Garratt and Co.," at 11 and 12, Finsbury Square, E.C. The subscribers (with one share each) are:—W. Light, "Lutterworth," Surrendon Road, Brighton, publisher; A. W. Light, 8, Priory Road, West Hampstead, N.W., medical electrician. Private company. The number of directors is not to be less than two or more than five; the first are W. Light and A. W. Light. Registered office, 11 and 12, Finsbury Square, E.C.

CITY NOTES.

Bombay Electric Supply and Tramways Co., Ltd.

THE directors report that the total revenue for the year to December 31st from all sources, including the amount represented by sale of current to the tramways, amounted to £256,699, an increase of £17,394, or 7·27 per cent. over the previous year. The total expenditure (says the *Financier*) amounted to £128,017, an increase of £2,292, or 1·82 per cent., compared with 1911. The net profit from the year's working, which aggregated £123,682, shows an increase of £15,101, or 13·28 per cent. After deducting interest on the debenture debt, amounting to £36,452, placing £22,000 to depreciation account, and £6,548 to sinking fund for capital redemption, there remains £63,682, plus £7,385 brought forward, making an available total of £71,067. The directors recommend that this sum should be applied to dividend on the 6 per cent. cumulative preference shares, and a dividend on the ordinary shares at the rate of 5 per cent. per annum, £30,000, leaving to be carried forward £5,072. The tramway traffic receipts, which amounted to £161,013, compare with £157,807 for the previous year. The working expenses in Bombay amounted to £78,842, against £74,449. The balance of receipts over expenses in respect of the year's working is £84,820, compared with £86,074 for the previous year. The tramway receipts for the previous year received an abnormal increase from the additional traffic which resulted from the Royal visit to Bombay in December, 1911. The receipts for the last three months of 1912 suffered from the refusal of the Corporation to continue the increase in some of the long-distance fares to which it had accorded temporary sanction during the preceding 2½ years. On the other hand, the expenses in 1912 were swelled by the thorough overhaul of the company's rolling-stock then undertaken. The gross receipts from electric supply for the year, including the amount represented by the sale of current to the tramways, amount to £91,413, compared with £76,530 for the preceding year. The working expenses were £45,683, against £48,264 for the previous year. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amount to £61,462, compared with £47,895 for 1911. The balance of £45,730, as the result of the year's operations, compares with a balance of £28,266 for 1911.

Aluminium Corporation, Ltd.

THE directors' report for the 12 months ending December 31st, 1912, states that the operations of the company were subject to many adverse factors, but a net profit is shown for the first time in the history of the company. The coal and transport strikes caused very serious inconvenience and loss, and the abnormal depression in the price of the metal which prevailed until towards the end of 1912, naturally militated against a more successful working. The completion of the new carbon works at Dolgarrog has been considerably retarded by the difficulty of obtaining the necessary building material. The machinery and plant having been maintained in a high state of efficiency out of revenue, it is not deemed necessary in the present accounts to make any provision for depreciation. An arrangement has been completed with the British Aluminium Co., Ltd., whereby that company has acquired a substantial interest in the Bauxite Refining Co., Ltd., and it is believed that the extensions at present being made to these works will prove to be of considerable advantage to the Corporation. Mr. A. F. Bott was appointed a member of the board in January last.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List :—

Consolidated Diesel Engine Manufacturers, Ltd.—Further issue of 4,413 shares of £1 each, fully paid (Nos. 594,547 to 598,959); and 100,000 vendors' shares of £1 each, fully paid (Nos. 427,077 to 527,076).

Consolidated Gas, Electric Light and Power Co., of Baltimore.—Further issue of $404,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each (Nos. 9,362 to 9,765).

London and Suburban Traction Co., Ltd.—1,411,409 ordinary shares of £1 each, fully paid (Nos. 1 to 1,411,409); 1,018,178 5 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 1,018,178); and £144,441 4½ per cent. first mortgage debenture stock.

River Plate Electricity Co., Ltd.—Further issue of £30,000 ordinary stock.

Underground Electric Railways Co. of London, Ltd.—21,000 additional shares of £10 each, fully paid (Nos. 7,201 to 8,200 and 26,793 to 46,792).

Victoria Falls and Transvaal Power Co., Ltd.—£1,000,000 5½ per cent. second mortgage debentures, Series "A" (Nos. 1 to 9,640 of £100, and 9,641 to 11,440 of £20 each), in lieu of the scrip.

Applications were made to the Committee (1) to appoint a special settling day in and to grant a quotation to :—

Brazilian Traction, Light and Power Co., Ltd.—100,000 6 per cent. cumulative preference shares of $100 each, fully paid.

And allow the following to be quoted in the Official List :—

Montreal Tramways Co.—Further issue of $2,890,000 first and refunding mortgage 5 per cent. 30-year gold bonds, Nos. D1,047 to 1,246 ($500) and M9,923 to 12,712 ($1,000).

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—A half-yearly meeting will be held at 106, Cannon Street, E.C., on 24th inst., at 11.30 o'clock a.m. Dividends are proposed as follows :—Preference shares, 5s. per share, less income-tax, being half-yearly dividend due on July 1st, at the rate of 5 per cent. per annum. Ordinary shares, 5s. per share, free of income-tax, being an interim dividend of 2½ per cent.

Provincial Tramways Co.—An interim dividend of 8d. per share on the ordinary shares is announced for the half-year ended March 31st.

The American Westinghouse Electric and Manufacturing Co.—The report for the year ended March 31st, 1913, as abstracted in the *Financial News*, states that the sales billed for the year were in excess of any previous year in the history of the company. The ratio of manufacturing profit to sales billed increased over last year, but unusually keen competition in all the company's activities prevailed and still continues. The value of unfilled orders as of March 31st, 1912, was $8,137,961 and as of March 31st, 1913, $12,061,473. The surplus as of March 31st, 1912, was $6,648,964. This balance was increased, by the net income for the year and various items detailed in the statement of profit and loss, to a gross surplus of $9,932,203. Against this surplus have been charged dividends declared during the year on the preference stock at the rate of 7 per cent. per annum ($279,909), three dividends of 1 per cent. each, aggregating $1,053,666, on the common stock, and miscellaneous charges totalling $283,187. These charges reduced the surplus to $8,315,442, against which depreciations of investments, aggregating $966,919 were written off, leaving the surplus as of March 31st, 1913, shown in the same balance-sheet, of $7,348,522. So far as the foreign companies are concerned, while further depreciation is possible in some of them, it will probably be more than offset by the appreciation of others : so that, after the final adjustment resulting from liquidation of the Russian company, it is believed that, under existing conditions, their aggregate book value will be a fair actual value. The four-year notes issued under the plan for the discharge of the receivers of the company matured January 1st, 1913, and were paid.

Electric and General Investment Co., Ltd.—The directors recommend the following dividends for the year ended May 31st :—Ordinary shares, the full dividend of 2s. per share, being 10 per cent. per annum, of which 1s. per share was paid on account in January, leaving 1s. per share to be now distributed ; deferred shares, a dividend of 6d. per share.

J. G. White & Co., Ltd.—The directors have declared a dividend of 6 per cent., less income-tax, on the cumulative preferred shares for the half-year to February 28th, making 12 per cent. for the year, and a dividend of 6 per cent., less income-tax, on the ordinary shares for the half-year to February 28th, making 12 per cent. for the year, and an extra dividend of 10s. per share, less income-tax, on the ordinary shares for the year to February 28th, making a total of 62 per cent. on the ordinary share capital.—*Financier.*

Prospectus.—*Midland Electric Corporation for Power Distribution, Ltd.*—The list was to close yesterday in an issue of £400,000 5 per cent. first mortgage debenture stock, which is guaranteed absolutely as to principal and interest by the British Insulated and Helsby Cables, Ltd. The matter was referred to in the report of the meeting of the latter company recently. The present issue is made to replace the whole of the company's outstanding debentures, amounting to £250,000, and to provide the additional capital required for its extended and rapidly-extending business. After providing for the replacement of such debentures, and for the payment to the British Insulated and Helsby Cables, Ltd., of £92,000 or thereabouts (being the estimated cost up to June 30th, 1913, of the new turbo and other extensions), the present issue will provide £58,000 in cash for the general purposes of the company, including further extensions, and for the expenses of this issue.

Pulford Bros., Ltd.—The fifteenth annual meeting was held at the office, 108, Whitechapel, Liverpool, on June 5th. We are informed that Mr. Egerton G. Pulford, who presided, reported that the business during the past year again showed a satisfactory increase. Resolutions declaring a dividend of 30 per cent., free of income-tax for the year ended March 31st last, and carrying the balance to reserve account, were passed. The chairman also reported that a contract had been signed to purchase 106 and 108, Whitechapel, with a view to rebuilding the premises to suit the growth of the company's business. At an extraordinary general meeting held immediately afterwards it was resolved to increase the capital by issuing 3,000 6 per cent. cumulative preference shares of £1 each.

Bahia Tramway, Light and Power Co.—Sir Wm. Plender presided at a meeting of the holders of the 5 per cent. 50-year first mortgage gold debentures held at Winchester House, E.C., on 5th inst., when the contract for the sale of the company's properties to the municipality of Bahia was ratified. Bondholders receive approximately £58 for each $500 debenture.

Official Announcements re Companies. — The following companies have been struck off the Register, and are accordingly dissolved :—

Bartitsu Light Cure Institute.
Carnarvonshire Electric Traction Syndicate.
Empire Electric Light and Power Co.
Improved Electric Supplies.

Unless cause is shown to the contrary, the following companies will be struck off the Register at the expiration of three months :—

Haste Pump Co.
Midgley's Electro-Therapeutical Co., Ltd.
Motor Traction Co. (1905), Ltd.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the year ended December 31st, 1911.

Western Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1913, being at the rate of 6 per cent. per annum.

British Electric Traction Co., Ltd.

THE directors' report, which is to be submitted at the annual meeting at the Holborn Restaurant, on Monday, June 16th, states that during the year ended March 31st, 1913, good progress has been made by the Associated Companies in regard to tramway traffic, the sale of electricity for light and power purposes, motor-omnibus services, and in other respects. The total traffic receipts on the lines which were in operation both last year and the preceding year show an increase for last year of £61,467, and the number of passengers carried an increase of 13,607,818. The aggregate traffic receipts were £1,749,246, as compared with £1,770,748 for 1911, a decrease of £21,502. The aggregate of passengers carried also shows a small decrease, but these decreases are due to the company's interest in several undertakings having been disposed of. The electricity supply receipts amount to £353,002, an increase of £35,564 as compared with 1911. The directors consider that the increases in the gross receipts from both the traffic and electricity supply branches of the business are satisfactory, but they regret that the net profits of the Associated Companies have not increased proportionately to the larger volume of business. The coal strike, the strike of transport workers and other labour troubles, have abnormally increased the cost of fuel, materials and stores of all kinds.

"The directors have for some time past felt that the advent of the modern and improved motor-omnibus would still further discourage the extension of tramways and light railways in Great Britain, and in some cases would have an important bearing on the profits of existing undertakings. There is a large scope for the employment of motor-omnibuses, especially in London, where the tramways do not, as is the case in provincial towns, serve the central and most populous areas, while in the provinces the cost of permanent way for tramways to serve outlying and sparsely populated places is not justified under existing legislative conditions. The Associated Companies have accordingly taken steps to provide a number of motor-omnibuses for working in connection with their tramways, and the British Automobile Traction Co., which is practically owned by this company, is establishing and developing motor-omnibus systems in districts not served by tramways and light railways. It is the policy of that company to assist local undertakings and to work in co-operation with local authorities and railway companies." The directors go on to refer to arrangements made with the L. G. Omnibus Co. in regard to motor-omnibus and other traction business in London and the provinces, and to the formation of the London and Suburban Traction Co.

The last-named company will control 123 miles of line, and several important electricity supply undertakings, and will operate, either directly or through its Associated Companies, about 380 motor-omnibuses. The British Automobile Traction Co. is also operating a fleet of motor-omnibuses in London and the suburbs.

The British Canadian Power Co., in which as stated in the last report the company had taken an important participation, has during the year been amalgamated with the Northern Ontario Light and Power Co., by means of an exchange of bonds and common stock of the British Canadian Power Co. for bonds, preference stock and common stock of the Northern Ontario Light and Power Co. The latter company has an issued share and debenture capital of over 11,500,000 dols., and is the only company supplying electric power, compressed air and electric light in Cobalt and the surrounding districts. The yield on the company's holding shows a good return on the cost at which it stands in the books of the company. Arrangements have been completed for the formation of a syndicate, in which the company has retained a substantial participation, for providing additional capital for the Maritime Coal Railway and Power Co. in the Province of Nova Scotia. The reports of the company's representatives and other experts who have examined the property are favourable. The company has in conjunction with Brazilian interests formed the Rio Grandense Light and Power Syndicate, Ltd., with a subscribed capital of £100,000. The syndicate has contracted to purchase the concession for electric tramways, lighting and power in the town of Pelotas in the Province of Rio Grande do Sul, Brazil, and the works are now under construction. The syndicate has also obtained options upon other electrical undertakings in the same district.

Negotiations are proceeding with regard to the establishment of other undertakings in England and abroad. The cost of these negotiations has been included in the expenses of the year and debited to revenue account.

The Electrical and Industrial Investment Co. is now established with a subscribed share and debenture capital of £480,000.

Increased dividends have been paid by the following companies, viz.: Airdrie and Coatbridge Tramways, Auckland Electric Tramways, Birkdale District Electric Supply, Birmingham District Power and Traction, Bombay Electric Supply and Tramways, Devonport and District Tramways, Gateshead and District Tramways, Greenock and Port Glasgow Tramways, North Metropolitan Electric Power Supply, Tramways and Light Railways Estates, and Yorkshire (Woollen District) Tramways, and several other Associated Companies show improved results. There are, however, a few companies which show diminished profits. The investments and undertakings of the company have in several instances been materially improved as the result of negotiations and agreements with local authorities and in other ways which are not reflected in the present accounts. The work done by the Federation for the Associated Companies is proving of great advantage in such matters of common interest as mutual insurances, rating and assessments, collective purchases of stores, the securing of advertisements on cars and the development of parcels carrying business. During the year the company's interest in the Leamington and Warwick Electrical Co. has been sold for cash, and the Hartlepool Electric Tramways Co. has been liquidated on sale of the tramways to the Corporation. The difference between the amounts at which the investments stood in the books of the company and the proceeds of these sales has been debited to reserve.

The gross profit for the year amounts to £210,880, as compared with £195,040 for 1911-12. After deducting management expenses and other charges, including the expenditure during the year on surveys and negotiations in regard to new business, there remains a balance of £189,712 plus £10,751 brought forward. After deducting debenture stock interest, £91,807, there remains a balance of £108,657. The revenue account has been debited with £7,732, being the amount reserved against or written off various assets. This includes £1,000 in respect of goodwill, which item now disappears from the accounts, and £1,500 in respect of previous expenditure on surveys and negotiations, reducing that item in the balance-sheet to the nominal amount of £1,000. The directors have in addition placed £40,000 to reserve for depreciation, and they recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock and a dividend of 3 per cent. upon the 7 per cent. non-cumulative preference stock, together amounting to £48,431, carrying forward £12,493. During the year the directors purchased in the market and cancelled £5,100 5 per cent. perpetual debenture stock and £18,265 4½ per cent. second debenture stock of the company. The outstanding debenture stocks have been reduced by these amounts and the difference of £4,368 between the nominal value and the purchase price has been added to reserve. Investments and undertakings, after deducting the reserve for depreciation, stand at £4,696,053. The yield for the past year was 4·11 per cent. as compared with 3·77 per cent. for the preceding year on £4,695,103. Investments which stood in the books at March 31st, 1912, at a cost of £472,994 were realised during the year, while investments were acquired during the year which stand in the books at £404,185.

The reserve against depreciation of investments has been increased by £4,368 in respect of debenture stocks purchased and cancelled; by £9,115 profit on sale of sundry investments, and also by £40,000 transferred out of the profits of the past year. The reserve has been debited with £124,759, being the deficiency in book value on realisation of the Leamington and Hartlepool undertakings above referred to, sale of Consols and other investments, and sundry investments written off. The balance at credit of this account is now £552,457, which amount is shown in the balance-sheet as a deduction from the amount at which the investments and undertakings stand in the books. There are additional reserves against specific assets of £64,299, and a balance carried forward amounting to £12,493. The reserves of the Associated Companies, including the balances carried forward, amounted at December, 1912, to £1,128,444.

Imperial Tramways Co., Ltd.

THE directors report as follows for the year ended December 31st last.

Middlesbrough, Stockton and Thornaby Electric Tramways.—The gross receipts were £56,719, as compared with £56,686 for the preceding year, an increase of £33. Passengers carried were 11,214,750, against 11,221,628, a decrease of 6,878. Net profit £17,413, as compared with £13,305. The work of reconstructing the permanent way has been continued, with the result that during the last two years two-thirds of the track has been re-laid. The reconstruction of the remaining portions is being proceeded with, and it is expected that the work will be completed by the end of the summer.

The working of the Corris Railway Co.'s undertaking shows an increase in net profit of £34.

The scheme for the consolidation of the interests of the London United Tramways with those of other companies is referred to.

The opportunity having offered of disposing of a portion of the company's investment in the London United Tramways, Ltd., the directors decided to reduce the holding in that company by selling 20,000 shares out of the 44,446 5 per cent. £10 preference shares. They hope to obtain an improved return upon the re-investment of the sum thus realised, whilst it is anticipated that the amount remaining in the London and Suburban Traction Co., Ltd., will contribute its quota to the future revenue.

The scheme of arrangement has received the sanction of the High Court, and accordingly the arrears of dividend on the preference shares to December 31st, 1911, have been cancelled and the ordinary shareholders have relinquished their exclusive rights to the ordinary shares dividend fund, which will in future form part of the dividends equalisation fund applicable to maintenance of the dividends on both preference and ordinary share capital. It has been deemed advisable to write down the investment in the London United Co., and £85,000 has been transferred from the reserve fund for renewals and contingencies for that purpose. The reserve funds will therefore now stand as follows:—For renewals and contingencies, £23,872; for Middlesbrough S. & T. renewals fund, £11,500; for dividends equalisation fund, £29,750.

In view of the various changes, information will doubtless be desired as to the future prospects of the company, and the directors therefore state that in their opinion the shareholders may now look for the regular payment of the preference dividend and the maintenance of at least 4 per cent. on the ordinary share capital, and in arriving at this conclusion they have only taken into account the receipt of dividends on the preference portion of the holding in the London and Suburban Traction Co., though there is no reason to doubt the statement made by the new company that there will also be a fair return upon its ordinary share capital.

The revenue account for the year shows an available amount of £24,256, and after payment of interest on debenture stock for the whole year there is a balance, including £7,678 brought forward, of £19,221, which the directors recommend should be appropriated as follows:—Dividend at 6 per cent. for the year on the preference capital, £11,300; dividend at 4 per cent. for the year on the ordinary capital, £7,533, carrying forward £388.

United Electric Tramways of Monte Video, Ltd.

THE directors' report for the year to March 31st, 1913, contains the following particulars of results of the operation of the tramway system for the year to October 31st, 1912 (the fiscal year of the Uruguayan Co.):—

	1911-12.	Increase over 1910-11.
Gross receipts	$1,627,636	$224,436
Operating expenses	934,852	140,160
Net receipts	$692,784	$84,276
At exchange of $4·7 to £	£147,401	£17,931
Passengers carried	40,736,202	6,074,064
Car-miles run	7,079,175	721,118
Percentage of operating expenses to gross receipts	57·44	·81

The increase in the ratio of working expenses to gross receipts is partly accounted for by the increase in rates of wages granted by the company having been in operation during the whole year, as compared with a period of about five months of the previous year. Fuel costs were also increased as a result of the coal strike in this country. The results for the year, however, again show satisfactory expansion. The extension of the Colon line was completed during the year under review, and has been in operation since June 20th, 1912. This increases the total mileage of the system from 86¼ to 88¾ miles of single track. The additional rolling stock has been in use since December, 1912. Sites have been secured for the erection of two sub-stations, and the necessary plant has been ordered. To increase the accommodation for rolling stock, a new car-shed is in course of erection. The existing central car-shed is also being extended, so as to provide additional space for repair and paint shops. Considerable expenditure will be necessary during the next year or two in connection with an extensive scheme for repaving of streets which has been commenced by the Municipality of Monte Video. These works will cause a temporary interference with some of the company's services. The amount received from La Sociedad Commercial de Monte Video in respect of dividend and interest was £138,084. The profit and loss account for the year, after providing for administration expenses, and charging £44,440 for debenture interest, shows a credit balance of £87,721. Adding £13,467 brought forward there is a total to be dealt with of £101,188. The following amounts have been set aside:—For redemption of debenture stock, £2,810; for redemption of the preference and ordinary share capital, £2,500; for renewals and contingencies, £30,000. Interim dividends were paid in December at the rate of 6 per cent. on the preference and 6 per cent. on the ordinary shares, absorbing £24,041. The directors now recommend dividends for the half-year to March 31st, 1913, on the preference shares, at the rate of 6 per cent. per annum (£12,712), and on the ordinary shares, at the rate of 8 per cent. per annum, making 7 per cent. for the year (£15,104), leaving to be carried forward £14,020.

The meeting will be held in London on June 16th.

STOCKS AND SHARES.

Tuesday Evening.

STOCK Exchange markets are passing through an extremely uncomfortable—not to say grave—period, and although the sentiment alters a little from day to day, for the last week it has leaned strongly to the side of flatness. Put in a nutshell, the causes of the trouble are nothing more sensational than our old friends the Balkans War and new issues, although arising out of these there are a variety of minor reasons which have contributed to the slump in speculative departments. On all hands one hears the question asked whether or not the Stock Exchange is drifting towards panic; and, viewed with what impartiality can be expected from members of the House, the position is generally declared to be one which is susceptible of being weathered without panic supervening. For all that, brokers and jobbers alike will sleep more comfortably in their beds after the turn of the present week.

The markets with which these notes are concerned have suffered in company with the rest of the Stock Exchange. The slump in Home Rails swept Metropolitans to 45½, a fall of 3½ on the week, Surplus Lands stocks losing 1 at 62. Districts fell 2½, Great Northern and City Preferred ⅛ to 2, Central London Preferred 4, the Ordinary and Deferred 2 points apiece. It is not as though the falls were confined to this week's list of prices; they follow upon heavy declines previously, and it is this cumulative flatness which weighs so heavily upon the markets. Various causes are assigned to account for the various falls. In Metropolitan, for instance, the weakness is said to be due to the opposition that is to be offered to the company's absorption of the Great Northern and City line, though a little reflection would, no doubt, remark as anomalous the drop in the shares of both companies concerned.

The truth of the matter is that in any stock where a "bull" account exists, stale holders have been doing their best to get out while they were able. The news that the London and South-Western electrification is about to be taken in hand made no difference to the prices of the stocks of that company; while the issues of the British Westinghouse Company, which has secured the contract, are unchanged. Possibly the sharp improvements of the past fortnight in Westinghouse may be due to advance buying on the expectation that the company would be given this important work.

It is not only ordinary stocks which have given way amongst Home Rails, but a number of the more gilt-edged varieties are down also, as may be seen by a reference to our lists. British Electric Tractions are reasonably steady on the issue of the report, but three of the stocks are ½ to 1 lower.

The market for English Electricity Supply shares is weak, for no reason other than that money has to be provided by the sale of actual investments in order to pay for other obligations. The dullness this week has affected more particularly the preference shares of the various companies, losses being sustained by those issues in the Westminster, Metropolitan, Edmundsons' and City of London Companies. "City Lights" ordinary have dropped to 15¾, the other ordinary shares in the catalogue maintaining their quotations with a good deal of firmness. One or two of the Debenture stocks, however, show small falls; and, like a good many investment securities round the Stock Exchange at the present time, it is difficult to deal readily in some of those stocks where the market is not distinguished for its freedom in the ordinary way. The prospectus of the Debenture issue by the Midland Electric Corporation is out this week; advance particulars were given here last month.

The report of the Bombay Electric Tramways Company caused some little disappointment. It had been thought from the dividend announcement, which raised the rate from 3 per cent. to 5 per cent., that a better showing would be made. Perhaps the optimists expected a little too much, for certainly the company is doing very well; and it is remarkable in these days, when securities are offered to pay such big rates of interest, that Bombay Tramway should stand at 13½, at which the return is but 3¾ per cent. on the money. The 6 per cent. Preference pay 5½ per cent.; but as the part of the recent buying of the Ordinary came from India, evidently the local investors have a high opinion of the undertaking.

The Anglo-Argentine Tramways group is a little dull, the last-issued Debentures showing slight falls, while City of Buenos Ayres Trams are ⅛ lower. No change occurred in United Electric Tramways of Monte Video upon the appearance of a report showing fine progress. Para Electric Trams are easier, both as regards the Ordinary and Preference.

News from Mexico is not bad, but the market in Mexican Power and similar concerns remains subservient to the depression prevailing through the rest of the House. In consequence of this, Mexican Light and Power Common show a loss of 5, and the 5 per cent. Mortgage bonds are down 2½, the yield at their present quotation being over 5½ per cent. on the money. In view of the security which these offer, the return looks tempting, for the lately-issued report was quite a good one. In view of the fact, however, that the Mexican Government itself is about to issue a 6 per cent. loan at 96½, upon which the return, taking redemption into account, will work out to 6¼ per cent., it is not surprising that bonds in the utility companies should suffer by comparison. At the same time, some investors take it as axiomatic that a well-secured bond from an industrial corporation may in some circumstances form a better security even than that offered by the loans of the country itself in which the company's works is situated.

Montereys are a point down, and Mexico Trams lost 2. A decline of 10 is marked in Montreal Light and Power shares, Shawinigan Water fell 4, Canadian General Electrics 3, these high-priced shares offering a target for the sellers. Brazil Traction Ordinary have undergone sharp changes during the past few days, and at 88, the price is 4 points down on balance, while Rio Tramways Second Bonds are 3½ lower at 90. The Victoria Falls Power report failed to realise some of the "bulls'" anticipations, and the price is dull at 17s. 6d. sellers.

The Telegraph market is troubled by realisations of actual stock on behalf of people who want money. The Eastern group is depressed, and Western Telegraphs are ¼ down. New York 4½ per cent. bonds shed 1. The quotation for West India and Panama shares is broadened by the dropping of the lower price. United River Plate Telephones have gone back to 6¾; and the Anglo-American Telegraph division continues to shrink. Marconis were, of course, unaffected by the decision in the Chesterton case. The price has again dwindled, Canadians going back to 10s., Americans to 13s. 9d. Men in the market were not the only ones to be amused by the tone of Lord Murray's replies to Sir Albert Spicer's invitation to come back before July in order to give evidence before the Marconi Commission.

The Manufacturing section presents few alterations. Castner-Kellners are a little easier, and it has already been remarked that the British Westinghouse issues retain their previous rises. Opportion is offered to the Edison & Swan scheme. The price of the "A" shares is nominally nothing to ¼, but some of the shareholders have been trying to rid themselves of the liability by offering to give money, if they can find a buyer who will take it, with their shares. The Rubber department is as weak as the rest of the Stock Exchange; and it is noteworthy that the issue of Preference shares by the Armstrong, Whitworth Company the other day resulted in the underwriters being left with 55 per cent. of their obligations.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9⅞ — 10⅛	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅛	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	10	8⅞ — 9⅛	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8½ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97 xd	..	4 2 6
Charing Cross, West End & City	5	5	5†	4 — 4⅛	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	— ⅛	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4	..	5 12 6
Do. Do. 4 % Deb... ..	100	4	4	91½ — 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 15 8
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	15 — 16½	— ⅛	5 9 1
Do. 6 % Cum. Pref.	10	6	6	11⅜ — 12⅜	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —102	..	4 8 3
County of London, Ord... ..	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 5 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	— ⅛	3 6 8
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2⅛	— 3/16	.. ..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7¾	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	8	2½	2½	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	—1	4 6 1
Metropolitan	5	4	4†	8⅛ — 8⅜	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	— ⅛	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	80 — 83	—1	4 4 4
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	101 —104	..	4 6 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	93 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 8⅝	..	5 12 8
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
South London, Ord.	4	5	6	2⅜ — 2½	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref...	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord...	£3	Nil	..	⅛ — ¼	..	.. ..
Do. 5 % Cum. Pref.	5	2	†	2⅛ — 3 xd	..	.. ..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	8⅛ — 8⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	— 3/16	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5⅛	..	5 14 8
Calcutta, Ord.	5	8½	8½	6⅜ — 7⅛	..	5 17 3
Do. 5 % Pref.	5	5	5	4 1/16 — 5 3/16	— 1/16	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	93½ — 95½	..	5 5 8
Canadian Gen. El. Com. ..	$100	7	7	112 —115	—3	6 1 9
Do. 7 % Pref.	$100	7	7	118 —123	—1	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	..	1⅛ — ⅞	..	5 14 3
Do. 5 % Deb.	100	5	5	94 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	95 — 97	..	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	3/8 — 7/16	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100 —102	..	4 18 0
Madras, Ord.	5	Nil	..	1⅜ — 1½	..	.. ..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	108 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	80 — 83	..	5 19 1
Mexican Lt. & Power, Common	$100	4	4†	67 — 70	—5	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	98 —102	..	6 17 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	—2½	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	79 — 82	—1	6 2 0
Montreal, Lt., H. and Power ..	$100	8	9†	210 —220	—10	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	.. ..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5	5	129 —133	—4	3 15 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	97 —100	— ½	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99 —101	..	4 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	+ ½	5 5
Victoria Falls Power, Pref. ..	1	11¼d.	17⅜d.	13/16 — 15/16	..	.. ..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	129 —132	—2	6 1 2
Do. Collat. Trust	$1000	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph ..	Stock	8	8	61 — 64	..	4 13 9
Do. 6 % Pref.	Do.	6	6	107½ —109	—1	5 10 0
Do. Def...	Do.	80/-	30/-	23½ — 24	..	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7 11/16 — 7 13/16	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	84 — 86	..	4 13 0
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15⅜ — 16⅜	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6½ — 7½	..	6 18 0
Direct United States Cable ..	10	5	4	5⅞ — 6⅛	..	6 5 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	128 —131	—1	5 6 10
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	7 11/16 — 7 15/16	— ⅛	4 11 6
Do. 4 % Mort. Deb.	Dc.	4	4	90 — 92	..	4 7 0
Eastern Extension	10	7	7	12⅛ — 12⅝	— ¼	5 11 0
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	93½ —100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	6†	11⅛ — 11⅝	..	5 3 3
Do. 6 % Pref.	10	6	6	12⅜ — 12¾	— ⅛	4 13 2
Great Northern Telegraph ..	10	18	20	30½ — 32½	..	6 3 1
Indo-European Telegraph ..	25	13	13	56 — 58	..	5 12 1
Mackay Companies Common ..	100	5	5	83 — 86	..	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	3 5/16 — 3 5/16	— 1/16	6 1 7
Do. 7% Cum. Partic. Pref.	1	17	..	2⅛ — 2⅜	..	6 3 8
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	3/16 — ¼	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	96½ — 97½	—1	4 12 4
Oriental Telep. and Elec. ..	1	8	10	1 1/16 — 1 3/16	— 1/16	5 10 2
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10	10½ — 10¾ xd	..	9 0
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	5	8	8†	6½ — 7	—1/16	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/16 xd	..	4 7 0
Do. 4 % Debs., 1 to ,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2½ — 3	— ⅛	4 3 4
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9⅝	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	12⅞ — 13⅜	— ¼	5 4 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 10th.	Rise + or Fall	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	1⅛ — 1¼	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	— ½	..
Do. Do. Deferred	100	..	..	5⅛ — 7½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	83 — 86	—1	6 19 6
Do. 7 % Non-Cum. Pr'f.	100	..	3	42 — 45	..	6 13 4
Do. 5 % Perp. Deb.	100	5	5	88 — 92	—1	5 8 8
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	8	8	79 — 81	—2	14 18 9
Do. Pref.	100	4	4	80 — 82	—4	14 17 7
Do. Def.	100	2	2	76 — 78	—2	15 2 7
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1908	100	5	5	97 —100	..	5 0 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅝ — 2⅛	— 1/16	Nil
Hastings Trams, 6 % Pref.	1	6	6†	13/16 — 15/16	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	93 — 95	—1	4 4 4
London United Trams, 5 % Pref.	10	Nil	..	4⅛ — 5	..	..
Do. 4 % Deb.	100	4	4	62 — 66	..	6 1 3

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations June 10th.	Rise + or Fall	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅞	1⅝	45½ — 45¾	—3½	3 8 11
Do. Surplus Lands	100	2¼	2⅜	61 — 63	—1	4 7 4
Do. 5½ % Deb.	100	5½	5½	85 — 87	..	4 0 6
Do. 5½ % Pref.	100	5½	5½	82 — 84	—1	4 8 4
Do. 5½ % Con. Pref.	100	5½	5½	79 — 81	—2	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32⅜ — 33¼	—2½	Nil
Do. 6 % Deb.	100	6	6	139 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	94 — 96	..	4 8 4
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 86	—1	5 4 8
Do. 5½ % Gtd.	100	5½	5½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5½	3⅞ — 4⅛	..	5 14 7
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	5⅛	..	2⅜ — 2⅝	..	..
Do. 5 % Pref.	1	5	5	3⅛ — 3⅜	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	6	..	⅜ — ½	..	8 0 0
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	9⅛ — 9⅜	— ⅛	Nil
Do. "A"	1/-	..	..	1⅜ — 1⅝	..	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	107 —109	—2	5 10 1
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	1½	6 †	87 — 88	..	6 16 4
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	3†	3⅛ — 3⅝	..	3 17 5
Do. 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4⅝ — 4¾	..	5 14 3
Do. 4 % Deb.	100	4	4	91½ — 93½	..	4 5 7
Do. 4½ % Deb.	100	4½	4½	97 — 99	—1	4 11 0
Do. 5 % Deb.	100	5	5	96 — 98	— ½	5 2 0
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	87 —89	—4	6 14 10
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅛ xd	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	124 —128	—2	6 5 0
Do. Pref. Ord.	100	6	6	108 —112	—1	5 7 2
Do. 5 % Pref.	100	5	5	99 —102	—1	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	92 — 94	—1½	4 10 5
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅜	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97⅛ —100⅜	..	4 9 7
Cape Electric Trams	1	2½	..	1/16 — 1/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅜ — 5⅝	— ⅛	4 13 0
Do. 4 % Deb.	100	4	4	93 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	7/16 — 9/16	..	..
Do. Pref.	1	6	..	29/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 1/32	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 8 1
Madras Elec. Tr. (1904), Deb.	100	5	5	103 —105	..	4 15 3
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	98 —100	—2	7 0 0
Do. Gen. Con. 5 % Bonds	..	5	5	88 — 91	..	5 9 11
Do. 6 % Bonds	100	6	6	95 — 98	—1	6 2 5
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅜ — 7½	— ⅛	6 18 0
Do. 6 % Pref.	5	6	6	4½ — 5	— ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99½ —101½	— ½	4 18 6
Do. 5 % Mort. Bonds	100	5	5	88½ — 91½	—3½	5 9 3
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	98 —100 xd	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	89¼ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	5 — 5⅜	..	6 10 3
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	96½ — 98½	..	5 1 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	— ½	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	1/16 — 3/16	..	8 0 0
Do. 6 % Pref.	1	6	6	3/32 — 5/32	..	7 2 2
Babcock & Wilcox	1	98	16	2 1/32 — 3 1/32	..	5 4 6
Do. Pref.	1	6	6	1 1/32 — 1 3/32	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/16 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	1/4 — 7/16	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅝ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	3/16 — 1/2	..	Nil
Do. Deb.	100	4	4	67 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	..	16 13 4
Callender's Cable	5	15	15	11 — 11¾	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	31/32 — 32½	— 1/32	5 9 6
Do. Deb.	100	4½	4½	103 —106	..	4 4 11

Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5		55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	3/16 — 5/16	..	..
Do. Pref.	1	6	6	31/32 — 1 1/32	..	7 13 10
Edison & Swan, A, £3 paid	5	Nil	..	0 — 1/16	— 1/16	Nil
Do. fully paid	5	Nil	..	1/4 — 1/2	..	Nil
Do. 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	2½	3½	1⅛ — 1 5/16	..	5 14 4
Do. Pref.	2	7	7	1½ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7¼ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½ xd	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 9 10
Do. Deb.	100	4	4	96 — 99	..	4 0 0
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57 xd	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

THE PROGRESS OF THREE-PHASE TRACTION ON RAILWAYS.

BY "DELTA."

THE first practical application of three-phase A.C. for electric traction was the equipping of the Lugano tramways in 1895-6 by Messrs. Brown, Boveri & Co., with three-phase induction motor equipments.

Since that time, the three-phase system has made slow but steady headway, especially in its application to heavy traction and railways. Several small lines were electrified in and around Switzerland, but the adoption of three-phase working by the Italian State Railways for nearly 150 miles of track on their various lines, immediately followed by the successful application of the system in the Simplon Tunnel in Europe and the Cascade Tunnel in America, seems to indicate that it deserves, and will hold, a high place in railway electrification of the future. Wherever the system has been tried it has proved highly satisfactory in operation.

It is the author's intention to set forth the main points to which the induction motor and the three-phase system in general owe their success in the electrification of railways, and, further, to briefly deal with the applications of the system up to the present date.

The relative advantages claimed by the three-phase system of railway electrification may be enumerated :—

1. No commutators are required whatsoever, and all commutation difficulties are obviated. The majority of induction motors used for traction are of the slip-ring type, but the more recent locomotives of Messrs. Brown, Boveri & Co. employ squirrel-cage motors, thus dispensing with everything of the nature of a moving contact.

2. The induction motor is capable of exerting two or three times its full-load torque for starting. The G.E.C. motors for the Cascade Tunnel of the Great Northern Railway Co., of America, are designed to exert three times full-load torque at any speed from standstill to within a few per cent. of synchronism.

3. The efficiency, power factor and speed are constant for a considerable range of output.

4. High voltages are employable on the motors themselves ; thus there is no necessity to load up the locomotives with transforming plant. Up to the present, 3,000 volts has only been exceeded in Europe in one case—the Gergal Sante Fe line in southern Spain, which operates on 5,500 volts, but the Cascade Tunnel line in America is supplied from 6,000-6,600-volt trolley wire. The standard voltage adopted by the Italian State Railways is 3,000 volts at 15 cycles.

5. Electrical braking and regenerative control is possible since the motors may be made to run as generators, with their rotors excited from low-voltage D.C., and supply current back to the line. The speed of the motors is then limited to approximately that of synchronism, and this may be made considerable use of, especially on mountain lines and very heavy grades. The tendency to limit the speed should not be affected by the removal of one bow or trolley from contact with the overhead wire.

6. When squirrel-cage motors are used there are no rheostatic losses at starting, and the starting efficiency may be brought up to 97 per cent.

7. By a suitable arrangement whereby resistances may be inserted in the rotor circuits, lost time may be made up on down grades.

8. The comparative cheapness of three-phase generating plant and sub-station plant in comparison with low-tension direct-current plant is yet another advantage of the system under some circumstances.

The advantages of the induction motor system are thus seen to be many, and although the control systems now in use for three-phase work appear to be elaborate, the following table shows them to be comparable in weight with the D.C., and superior to the single-phase equipment.

The disadvantages of the system are :—

1. The necessity of employing two overhead wires which, to some extent, limits the voltage allowable owing to the difficulty of insulating one from the other, especially in tunnels where there is much moisture present. The two overhead wires are also liable to short-circuit at cross-overs.

2. The increased rail drop consequent on the use of any A.C. system presented another difficulty, which has been, however, largely overcome by the use of a low frequency. The frequency employed on the earlier three-phase railways ranged round 40 cycles. In recent practice 15 and 16 cycles are more generally adopted, as in the case of the Simplon tunnel line.

3. Where heavy trains are employed and two locomotives are used for hauling, it is essential that their wheel diameters should be identical, otherwise they will not share the load.

Both the Italian Westinghouse Co. and Messrs. Ganz and Co. have an ingenious method of overcoming this difficulty by the use of a water resistance in the rotor circuit, in which the water level can be automatically controlled by compressed air.

Yet another feature, repeatedly put forward as a disadvantage, is that induction motors require a very small air-gap to maintain a decent power factor. In the old type 150-H.P. motors of Messrs. Brown, Boveri and Messrs. Oerlikon the gap was $\frac{1}{10}$ in. on a 24-in. diameter rotor. In the G.E.C. motors for the Cascade tunnel $\frac{1}{4}$ in. air-gap has been allowed, and yet the power factor has been kept up to 80 and 86 per cent. It is obvious that $\frac{1}{4}$ in. air-gap will allow for a great deal of bearing wear and of the rough usage a railway motor is bound to encounter in the shape of sudden and heavy starting strains. The actual motors, taken all round, are well suited to traction work. This may also be said of the control systems. The series parallel arrangement in direct current work only allows of two economical speeds in which to run the motors :—(1) Full series ; (2) full parallel.

TABLE I.

Railway.	Weight of loco.	H.P. of loco.	Weight of motors.	Weight of control.	Loco. weight in tons per H.P.	Controller weight in tons per H.P.	System.
Pennsylvania ...	418	4,000	40	17	·037	·0042	D.C.
Detroit River Tunnel	90	1,200	18·8	6·2	·085	·0052	D.C.
New York, New Haven and Hartford ...	90	1,000	26·4	22·1	·090	·0221	1 ph.
Lötschberg Tunnel ...	86	2,000	19·6	22·4	·043	·0112	1 ph.
Simplon Tunnel ...	68	1,700	24·5	10·5	·040	·0062	3 ph.
Valtellina*	62	1,500	13·1	18·9	·041	·0126	3 ph.

* This includes weight of twin L.T. motor for starting.

This is not the case with induction motors. By suitably arranging the poles so that they may be changed in number, three and four synchronous speeds may be obtained. This is also true where the cascade or concatenated arrangement of motors is used. Hence the induction motor may be provided with two, or more than two, economical working speeds in excess of those which the ordinary D.C. series motor possesses. There is a considerable amount of choice in the control system for induction motors. The simplest is that employed on the earlier locomotives in Europe and more recently on the locomotives in the Cascade Tunnel. This consists of the ordinary secondary rheostatic control, where resistances are placed in the rotor circuit at starting and cut out as the speed increases. Such an arrangement possesses but one economical working speed and allows heavy rheostatic losses.

The next system was that employed in the Simplon Tunnel locos, and also by Messrs. Oerlikon, of changing the number of stator poles as the speed increased. Thus a motor would be started up in the usual manner with control through rotor resistances and run up to full speed as a 16-pole motor. The pole-changer would then change it to an eight-pole motor and re-insert the resistances, which would again be slowly cut out till the motor ran at full speed as an eight-pole motor. Messrs. Oerlikon have in some cases constructed motors capable of four arrangements of poles, thus giving four speeds. For lines where there are frequent stops the arrangement allowed of heavy rheostatic losses as before mentioned, hence Messrs. Ganz & Co. developed the cascade arrangement of motors to suit traction work. They arranged to insert a separate low voltage motor in series

TABLE II.—THREE-PHASE RAILWAYS IN OPERATION.

Railway.	Firm.	L'gth.	Date.	Volts.	Frequency.	Locos.	Motor-cars.	H.P. per motor.	No. motors.	W'ght.	Max. speed.	—
Burgdorf Thun	Brown, Boveri	M. 25·2	1899	750	40	2	—	150	2	30	11·2/22·4	Squirrel-cage four-speed motor, with pole-changing device.
						1	—	250	2	42		
							6	60	4	32	22·4	
Valtellina Railway ...	Ganz & Co.	65·8	1902	3,000	15	2	—	225	4	46	21	Loco. B-B.
			1903			3	—	750	2	62	42	Loco. 1-C-1 Cascade motors.
			1905			4	—	1,500 & 1,200	2	62	42	Loco. 1-C-1. See text.
			1907									Loco. -E-.
						2	—	1,000	2	60·2	30	Cascade motors.
						—	10	75	2	53	43	
Simplon Tunnel	Brown, Boveri	4·3	1906	3,000	16	2	—	550	2	63	21·8	Loco. 1-C-1 pole-changing device, 16 and 8-pole and rheostatic control.
						2	—	850	2	—	43·6	Loco. D. See text.
Brunnen Morschbach ...	Oerlikon	1·7	1906	750	50	1	—	85	2			
Cascade Tunnel	American G.E.C.	3·6	1907	6,000	25	4	—	325	4	104	16	Loco. B.B. rheostatic control.
Santa Fe Gugal (Spain) ...	Brown, Boveri	15	1908	5,500	25	5	—	160	2	26	7·8/15·6	Squirrel-cage locos. coupled in pairs.
Campasso Bussala ...	Westinghouse (Italian)	13	1911	3,000	15	40	—	1,000	2	60·2	—	Loco. -E- similar to later Valtellina locos.
Savona Guisseppe ...	Westinghouse	13·5	1911 & 1912	3,000	15	15	—	1,000	2	60·2	—	Same as above.
Modane Bardonuchia Busseleno (Tunnel).	Brown, Boveri	32·2	1912	3,500	16⅔	—	—	—	—	—	—	Loco. at present borrowed from Campasso Bussala line.

with the H.T. motor rotor in starting. This gave an additional economical speed to the loco. Originally, the low voltage motor was built into the same frame as its high voltage companion. The arrangement was used in the earlier Valtellina locomotives with great success, as it gave the locomotive two economical speeds. (1) Full cascade connection; and (2) full short-circuited rotor connection of the H.T. motor. This success led Messrs. Ganz & Co. to still further develop their system. The more recent locomotives of the Valtellina line are equipped with two motors each, one an eight-pole motor and the other a 12-pole motor, each capable of working the train alone, and thus giving two synchronous speeds to the locomotive. A lower synchronous speed is attained by placing the 12-pole motor in cascade connection with the eight-pole machine. Using the H.T. 12-pole motor for cascade connection necessitates its being arranged to work at a reduced voltage. This is done without the aid of any auxiliary transformer by changing the stator windings from their H.T. arrangement of three coils in each phase in series, with the phases star connected, to the lower tension arrangement of three coils in each phase in parallel, with the phases mesh connected.

This cascade arrangement gives a speed equivalent to that of a 20-pole motor. In each arrangement the rotor resistances are cut out in the usual manner, giving a fine regulation of speed. This is done with water resistances instead of rheostine wire, as in the original locomotives. These locomotives then have speeds corresponding to 20, 12 and eight-pole motors, at which they can operate with perfect economy. These actually correspond to 16, 26 and 40 M.P.H.

The induction motor for traction is very similar in construction to the ordinary motor used for other commercial purposes. Where the motors have to be placed within the wheel truck, it is necessary to employ recessed bearings. The frame for carrying the laminated core is made as light as possible.

Messrs. Ganz & Co. found they had not room to spare for the slip-rings inside the frame, since it was more necessary to bring the cranks as near the motor as possible, hence the slip-ring leads were carried through the crank to a set of rings outside the frame of the locomotive.

Having dwelt on the most prominent points in connection with the three-phase system, the author will briefly deal with three of the most important undertakings now in operation.

The Valtellina line runs along the shores of Lake Como between Lecco and Callico, with branches to Sondrio and Chiavenna. The electrical equipment is by Messrs. Ganz and Co., and on the motor-cars consists of four motors per car—two high-tension 3,000-volt, 200-H.P. motors and two low-tension 300-volt motors for cascade connection in starting. The frequency is 15.

Three locomotives were also supplied, in the first instance, of the four-axle type, and having a speed of 18½ M.P.H., equipped with two 750-H.P. motors.

Soon, however, some 1,500-H.P. locomotives were added, which had two speeds of 20 and 40 M.P.H. In these locomotives the motors were mounted high up in the cabs, thus securing a higher centre of gravity and also allowing the use of fewer and larger motors. This latter is a great advantage, since, in all traction work, the weight per H.P. of a large motor is always much less than that for an equivalent output in smaller motors.

The power is transmitted to the driving wheels through a form of scotch yoke. Three pairs of 59-in. drivers are coupled together. The yoke which transmitted the power from quartered cranks on the motor shafts, drives down on to the middle pair of drivers through a special sliding bearing which will allow for the vertical movement of the axles independently of the locomotive main structure. Connecting rods to the two other pairs of drivers are taken from the yoke at points near this bearing. This arrangement has proved light in construction and very successful in operation. The control systems have already been dealt with.

2. Following the Valtellina line, the Simplon Tunnel was electrified with three-phase A.C. by Messrs. Brown, Boveri at their own risk, and proved so successful that the international authorities controlling this important line have taken over the system to work the tunnel permanently.

The original locomotives are practically identical in construction with those of the Valtellina line, both being built to the designs agreed upon by the engineers of the governments and firms concerned.

The mechanical construction is by the Swiss Locomotive Co. of Winterthur. These motors had two synchronous speeds of 22 and 44 M.P.H., and employed the usual pole-changing apparatus. Rheostine wire resistances in the rotor circuit allowed speed regulation. The rated output was 1,100 H.P.

Later, Messrs. Brown, Boveri put some further locomotives in service, which have four pairs of drivers and no pony wheels. These are rated at 1,700 H.P., and employ two motors. The motors have no slip rings, and no rotor resistances are used. The stators are capable of having their windings arranged so that speeds corresponding to 16, 12, 8 and 6-pole motors are obtained. This is done by a compressed air operated pole-changer, which, together with an auto-transformer for reducing the heavy current at starting, constitutes the whole of the control apparatus.

3. Outside Europe, little three-phase work has been done, but the Cascade Tunnel of the Great Northern Railroad of America, equipped by the G.E.C., is the exception. These locomotives develop 1,900 H.P., and are operated from 6,000-

6,600-volt overhead lines. However, in their construction simplicity seems to have been the great aim, and economy in service was set aside to gain this.

The motors operate at 500 volts, and the loco. therefore carries transformers to step the line voltage down to this value. The frequency is 25 periods and the speed about 15 M P.H.

From this summary of the progress of three-phase traction it appears the system is becoming more popular, and the author ventures to predict that the electrification of the future will find the high-tension direct-current and the three-phase systems occupying higher places as rivals to the single-phase system. One advantage of the H.T. D.C. is the great ease with which the voltages may be varied from H.T. in country districts to L T. in the towns, and yet permit the use of the same equipments. This is not so easily accomplished with the three-phase, and is perhaps one of the greatest limitations of the system. On the other hand, the direct-current system does not allow of so many economical working speeds as the induction motor fitted with pole-changing gear does. This may be a disadvantage in the D.C. system.

Some authorities pay more attention to economy in the construction and operation of the plant up to the trolley wire rather than the actual rolling stock. In this respect the three-phase system possesses many advantages. For any given output the cost of generation and of generating stations is approximately equal, but the three-phase railway sub-station is simply a transformer house, whereas with D.C. it is necessary to employ rotating converting plant often in conjunction with transformers. However efficient these sets may be, they must constitute an additional source of expense. Whether this expense is justified by the simplicity of rolling-stock equipment secured with D.C., is a debatable point beyond the scope of this article.

ELECTRICAL HEATING.

[COMMUNICATED.]

THE writer's attention has been drawn by the ELECTRICAL REVIEW to the increasing prominence given every year to questions concerning the application of electricity to domestic uses, such as heating and cooking. Almost every electric supply company or Corporation realises the advantages it will reap if only it can popularise the consumption of electricity in this direction, and the larger supply companies and Corporations now give annual exhibitions, with the view of educating the general public to the possibilities and advantages of electricity in the home. There is no doubt that, due to these exhibitions and also to the lower rates per unit now being charged for energy used for this purpose, electricity is being adopted on a larger scale every year by ordinary domestic consumers in this connection. Is this progress as rapid as it might be? Most people will agree that it is not. It is true that supply authorities have to overcome a prejudiced public, which cannot be done in a day, but the lack of progress is also due to the unscientific manner in which the subject has been tackled both by the manufacturers and by those engineers who advocate its use. It is the object of this article to give to those who are interested in this question the conclusions arrived at by the writer as a result of his investigations in this field.

A few years ago the writer had occasion to carry out some research work to investigate the respective merits and demerits of various makes and types of electrical heating apparatus then on the market. The great argument then in favour of electrical heating apparatus was that all the energy expended in the different apparatus was turned into heat, and therefore the heater had an efficiency of 100 per cent. At first sight this argument seemed quite plausible to those who had not given much thought to the question, but it must have occurred to many that it was at least curious that every electrical apparatus, quite irrespective of design, could possibly be equally good and efficient, and that it only remained for the manufacturers to turn out reliable and attractively-designed heaters.

Before going any further it would, perhaps, be just as well if the term "efficiency," as applied to electric heaters (or any heater, for that matter), were defined. Efficiency used in this sense should be represented by the following equation :—

$$\text{Efficiency} = \frac{\text{Useful heat developed.}}{\text{Heat absorbed in the heater.}}$$

The denominator of this equation is easily determined, as the heat units absorbed per hour is simply the number of B. of T. units consumed multiplied by 3,412. The numerator, on the other hand, is not so easily defined, and can only be arrived at as the result of experiment.

It would appear that manufacturers start away with the idea that the efficiency of any electrical heater is 100 per cent., and that it only rests with them to introduce cheap and attractive designs. This is, of course, a mistake. It is possible to conceive of a convector (non-luminous radiator) placed on the floor of a room in such a position relatively to a ventilator that the convector would take the place of an exhaust fan, and tend to cool the room rather than heat it. For instance, a popular way of testing a convector is to sprinkle some charred paper over the top of the convector and observe whether the paper is blown up to the top of the room or not; if the paper is carried up, the convector is supposed to be very good, as it produces a strong circulation of hot air. Now, imagine there is a ventilator in the ceiling immediately above the convector which can produce this supposed desirable circulation of air; it would be found if the paper test were applied that the paper would be blown to the top of the room and out at the ventilator, and so also would the hot air which was intended to heat the room. A heater of such a type and placed in such a position relatively to the ventilator would be worse than useless.

The foregoing remarks prove pretty clearly that the question of heating cannot be considered apart from the ventilation scheme, that is to say, if it is to be carried out successfully and efficiently. This applies to all heating systems, but especially in the case of electric heating, because if electric heating is to compete successfully with coal and gas fires as to running costs, it must necessarily be run efficiently. We may safely say therefore that electric heaters should be chosen with due regard to the ventilating scheme. As a rule, in most dwelling rooms and offices there is no definite scheme of ventilation, and in such rooms where artificial heating is resorted to a cold draught of air along the floor results.

The next question to be considered is what we mean by an ideal system of heating. It will be generally admitted that the ideal would be a room evenly heated throughout, and thus free from cold draughts, due regard, of course, being given to the ventilation. The temperature in the room should not be any higher than is necessary, in order to keep the body comfortable. Most people will agree that if one's feet are warm, it is a simple matter to keep the rest of one's body warm. A heating system should be such, therefore, that the hottest part of the room is near the floor and not the ceiling. With such a system the rest of the air in a room could be kept at a minimum temperature, which, from a health point of view, is very desirable, as one would not run the same risk of catching a chill by going into the cooler outside atmosphere that one would if the room temperature were excessively high. A heater that can be made to perform the above functions is much to be preferred to one that, however it may heat the air of the room near the ceiling, induces a cold draught near the floor, as this means "hot heads and cold feet." The writer arrived at the above conclusions after carrying out a number of experiments with various kinds and types of electric convectors and radiators. The tests, which were carried out in a small room, consisted of placing a number of thermometers (about 14) in the room in different positions and at different heights, and observing the temperature rise of each after stated intervals, and so determining the manner in which each different device heated the room. None of the heaters which were experimented with heated the room efficiently; some of them heated the ceiling first, and others concentrated the heat too much in one part of the room. After due consideration the writer came to the conclusion that his ideas could only be successfully carried out by means of luminous radiators, as the difficulty with convectors was that it was not possible to direct the heat where it was wanted, whereas radiant heat could by means of suitable reflectors be directed to any part of the

room without difficulty. Some people are inclined to imagine that a certain amount of power is wasted in a luminous radiator because it gives off light; this loss of power is so small, however, that it can be neglected, and is more than counterbalanced by the cheerier appearance obtained.

In order to carry the above ideas into practice a luminous radiator was designed which consisted of an ordinary horizontal radiator lamp having a consumption of 250 watts, placed horizontally and at the focus of a parabolic reflector. The lamp and the reflector were fixed relatively to one another and the reflector which held the lamp was supported on a frame which stood some 12 in. off the floor. The reflector was held in such a manner that it could be tilted so that the heat rays given off could be directed at practically any desired angle with the floor. As the rays given off by such a reflector would be in parallel lines, by tilting the reflector any desired heat density could be arranged. The radiator was purposely designed in small units so that by placing these at suitable points round the room concentration of all the heat at any one point was avoided. In the subsequent tests with this form of radiator, the heaters were placed in such a position, and the reflectors tilted at such an angle, that the floor appeared to be equally well covered by luminous heat. The results obtained were almost exactly what might have been anticipated, *i.e.*, the atmosphere throughout the room was very nearly uniform whilst the hottest part of the room was the floor which was in direct contact with the radiant heat rays. The tests were particularly satisfactory, as they showed that it was possible to utilise all the power absorbed by the radiator as useful heat. Very little heat was given off from the radiator by convection, the reflectors remaining practically cold after the heater had been on for some hours; it was, therefore, safe to assume that all the heat given off was in the form of radiant heat, and as this was all reflected on to the floor the heat was all turned to a useful purpose.

One of the great advantages of radiant heat, apart from its pleasing effect, is that it is not necessary to switch on the radiator for any length of time before using a room, as its full heat becomes apparent directly one comes in line with the heat rays.

One of the chief arguments put forward by opponents to electrical heating (although they admit the system is feasible) is that it is much too costly for the ordinary man in the street. Any such statement can safely be refuted provided that electricity can be obtained at 1d. per unit, as against gas at 2s. 6d. per 1,000 cb. ft., as if electricity is properly applied it is just as cheap as gas.

To take a concrete case where a man has a small office in which he spends most of his time sitting at a roll-top desk; one radiator such as described above placed in the knee hole, screwed to the back and at the top, the reflector being tilted to reflect the heat on to the floor, should prove ample to keep that man warm. The cost per hour with electricity at 1d. per unit is only ¼d., and it is doubtful whether either a coal or gas fire could show such good results at the price.

A room having a floor area of 200 sq. ft. should not require more than a unit of electricity per hour to heat it under ordinary winter conditions in England, provided, of course, the heat is used to the best advantage.

The scheme the writer would like to see adopted, and, no doubt, it will some day come along, is that every house should have a proper system of ventilation. A very good form of ventilation to adopt with a heating system such as outlined above, is to draw fresh air in and along one side of the room near the top, and expel the vitiated air by means of an exhaust fan placed in the opposite wall and at the same height. Suitable convectors could be placed in the air inlet, which could be switched on in very cold weather to augment the heat given off by the radiators.

Electricity in Agriculture.—The *Fruit Grower* states that very careful trials in electro-culture are being carried out this year at Dumfries and Balmakewan, as well as by the U.S.A. Department of Agriculture, to which a set of Lodge high-tension discharge apparatus has been supplied. The Egyptian Government Department of Agriculture has also a set on order.

AGREEMENTS FOR "HIRE" AND "HIRE-PURCHASE."

By "EXCELSIOR."

It is generally recognised that, where the law permits, electrical undertakings should have a department for hiring out motors and other consuming devices whose purchase prices are high. It is incumbent on these undertakings also to see that their interests in this connection are safeguarded from unscrupulous consumers, by having definite regulations laid down for the operation of these appliances, and to have concise terms formulated, so that no dubiety can possibly exist in the consumer's mind as to the conditions under which the "hire" or "hire-purchase" is granted. It is necessary, therefore, that an agreement should be drawn up in each case so that the obligations of both parties may be clearly set forth before the hiring is commenced.

An agreement has been defined as "An act in the law whereby two or more persons declare their consent as to any act or thing to be done or forborne by some or one of those persons for the use of the others or other of them." Some Corporations and Borough Councils are content with the hirer's simple note of hand, while others draw up elaborate instruments and have them embossed with 10s. seals to ensure their legality in case of disputes arising between the hirers and the supply authority.

The validity of an agreement does not, however, depend on the seal which it bears. If it is a simple unsealed document, there must be some worthy consideration for the promises made by either party to the agreement before it can be held as valid; while an agreement under seal is binding even without any consideration. It is not necessary, therefore, to affix a seal to an agreement for the "hire" or "hire-purchase" of a motor or cooker, as both parties have certain obligations to fulfil. A hire agreement, written, printed, or partly written and partly printed, will be held as quite satisfactory in a court of law, provided a sixpenny stamp has been cancelled on the agreement form. The wording should be almost always of a formal nature, expressing the intention of the parties in correct legal language, and avoiding punctuation as much as possible.

The commencement of the agreement should be "An Agreement made," and then the date should follow. After an accurate description of the parties, including the names, residences and occupations, each party may be subsequently indicated by reference to the character in which they enter into the agreement, as "the owners" or "the hirer." The order in which the parties are placed at the beginning should be maintained throughout the document. With regard to the remainder of the agreement, brevity and simplicity will be attained by following the order in which the subject-matter would seem naturally to fall; for example, after the introduction and particular promises of both parties have been set forth, the agreement should wind up with general provisions relating to valuations, arbitration, &c.

In drafting agreements for "Hire" or "Hire-Purchase," extreme conciseness is required, and as far as possible, avoidance should be given to the words "reasonable" and "proper," as these, in many cases, leave the matter open to question as to what *is* reasonable or proper? In certain instances, however, these terms may be used where the intention leaves no room for doubt. The signatures of both parties should be appended to all agreements, as difficulties often arise in proving assent by the non-signing party. It is not essential that the signature of a party should be attested by a witness, but a testing clause may be added as follows: "In witness whereof the said (parties) have hereunto set their hands the day and year first above written."

An adhesive stamp of the value of sixpence should be cancelled by the person by whom the agreement is *last* signed. A full inventory of the apparatus supplied on "Hire" or "Hire-Purchase" should be included in the form, and reference to the details should be made in the agreement. If, through any special circumstance, marginal additions or corrections require to be written on the printed form, the initials of both parties must be placed in proximity to the additions or corrections to show their respective concurrence in the alterations. It is better that two copies

of the agreement be made and signed by both parties, each party retaining a copy in his possession. This arrangement is, of course, quite arbitrary, but the consumer considers himself in a safer position when he can refer to the signed agreement should he be in doubt about his obligations at any time.

The following form of agreement has been drafted for the guidance of supply authorities who let out motors and other appliances on "Hire" or "Hire-Purchase" terms. With little correction it may be adapted to suit the requirements of many undertakings whose conditions of hire vary from the conditions given in the specimen form.

HIRE OF ———.

An agreement made the ——— day of ——— between ——— (hereinafter called the owners) of the one part, and ——— (hereinafter called the hirer) of the other part. Whereby it is agreed as follows:—

1. The owners will let to the hirer a ——— (hereinafter called the ———) detailed in the schedule hereunder written, to consume electricity from the owners' mains, and on or before the ——— day of ——— to be placed in the premises occupied by the hirer, situate at ———, for the term of one year from the ——— day of ——— next, at the yearly rental of ———, payable quarterly in advance on the ——— day of ———, the ——— day of ———, the ——— day of ———, and the ——— day of ———, the first payment to be made on the ——— day of ——— next.

2. The owners will supply and fit up the ——— on a foundation to be prepared and paid for by the hirer. The cables, tubing, switches and cut-outs between the owners' service fuses and the ——— shall also be provided and paid for by the hirer, and the work will be subject to the conditions and regulations issued by the ——— for the wiring of consumers' premises.

3. The owners will, during the period of hire, inspect and examine the ——— from time to time, and will replace, on request, such part of the said ——— as shall be worn out or destroyed or damaged by damp, or by the use and wear thereof be rendered unfit or unsuitable for the use of the hirer.

4. The owners will indicate by a plate affixed to the ——— that the same is the property of the owners, and the hirer shall not remove the plate without the written consent of the owners.

5. The hirer will pay the said rent without any deduction, keep the said ——— clean and in good order and condition (in which he admits the same now to be), and preserve the same from injury, except such as may be occasioned by damp or by the use and wear thereof, and deliver up the said ——— to the owners, or to such other person as they shall by writing appoint at the end of the hirer's tenancy, clean and in good order and condition.

6. The hirer shall pay the cost of all lubricating oil and carbon brushes, which must be purchased from the owners.

7. The hirer shall permit all servants of the owners to have access to, and inspect, the ——— at all reasonable times, every such servant producing to the hirer on demand a card authorising him to inspect the said ———.

8. The hirer will not remove all, or any part of, the said ——— to any other place or places without the consent, in writing, of the owners, nor without such consent underlet or otherwise part with the possession thereof to any other person or persons whomsoever, unless by law required so to do.

9. In case the said ———, or any part thereof, shall be damaged by fire or water, or negligently or wilfully destroyed or rendered useless by the hirer, the hirer will within ——— days next after such destruction or damage respectively, either replace the ——— or part thereof with a similar article of equal value, or pay unto the owner the full value of such article or articles as shall be so destroyed or damaged.

10. The owners may determine the agreement and take possession of the said ——— and for that purpose enter upon any premises on which the same shall be if default is made for ——— days in payment of any instalment of ——— after the same is due or if the hirer commits any breach of any stipulation hereby made binding upon him.

11. The hirer may determine the hiring at any time by requiring in writing the owners to remove the said ——— at his risk and cost and paying up all payments which, at the date of such removal, have accrued due hereunder.

12. The determination of the hiring by either party shall not affect the right of the owners to recover from the hirer all rentals which shall have accrued due at the date of such determination and damages for the breach of this agreement.

In witness whereof the said ——— and ——— have hereunto set their hands this ——— day of ——— in the year ———.

Signature of Owners .....

Signature of Hirer .....

6d. Stamp.

SCHEDULE ABOVE REFERRED TO.

Type of .....

Maker ..... Maker's No. .....

H.P. ..... Volts ..... Amps. ..... R.P.M. .....

Diameter of pulley ..... Slide rails or bedplate .....

Type of starting switch .....

Maker ..... Maker's No. ..... Amps. .....

Ammeter ..... Amps. .....

D.P. Switch ..... Amps. .....

D.P. Fuses ..... Amps. .....

Other appliances .....

.....

The "Hire-Purchase" Agreement will be almost identical to the "Hire" form, with the following exceptions:—In Clause No. 1 the words "one year" will be altered to suit the period of hire-purchase, and a conclusion to this clause appended as follows:—

"Upon payment by the hirer of ——— quarterly payments of ——— each to the owners the said ———shall become the absolute property of the hirer, but until such payment has been made the ——— shall remain the sole property of the owners."

In Clauses 4 to 9 inclusive, the phrase "during the period of hire-purchase" should be inserted at a suitable place in the composition. The word "rentals" in Clause 12 should be replaced by the expression "hire-purchase instalments."

Under the Electric Lighting (Amendment) Act, the proprietor's power of distraint does not apply to electrical apparatus on "hire" or "hire-purchase" in a consumer's premises, so that it is not absolutely necessary to obtain the proprietor's signature to the agreement.

The proprietor's consent to the placing of the motor or cooker in the premises should, however, be obtained in writing, and it will add to the effectiveness of the document if a note regarding his power of distraint is also inserted in the proprietor's memorandum. A suitable form is given below:—

PROPRIETOR'S MEMORANDUM.

——— the undersigned, hereby agree to the installation of a ——— in the premises at ——— occupied by ——— and ———also agree that should the tenancy of the within mentioned hirer become determined at any time the within mentioned owners shall be at liberty to enter the said premises and remove the said ——— and ——— further agree that ——— powers of distraint shall not apply to the said ———.

Signature of proprietor or agent .....

Address .....

Date .....

Worm-Gear Testing.—A paper read recently by Mr. F. W. Lanchester referred to a new method of testing introduced in a machine built, to the author's design, by the Daimler Co. With it efficiency tests can be made with great accuracy, the average error being probably less than one-tenth of 1 per cent. The National Physical Laboratory certifies the accuracy as within one-fifth of 1 per cent. In the course of his remarks, the author said that many facts of importance had been elucidated by the new method, among them that the loss of efficiency at reduced speeds is far less than previously supposed—in motor-car work it rarely falls below 94 per cent. The importance of lubrication was shown; mineral oils were found inferior to others, the viscosity of the oil is no guide to its suitability, and too much lubricant lowers efficiency. The heavier loads are carried with the best results at high speeds of revolution.

Booming the Electric Motor Vehicle.—Further evidence of the activity of the Electrical Vehicle Association of America in booming the use of electric motor vehicles was seen in the two-day Congress just held in Boston, when about 1,000 central station men were present. Among the papers read was one on "The Growing Popularity of Electrics," by Mr. H. H. Rice; another on "How a Central Station can develop its Electric Vehicle Load," by Mr. W. C. Anderson, and one on "What Service should the Central Station furnish Owners of Electric Cars," by Mr. L. R. Wallis.

Canadian Tariff on Electric Stoves.—The Canadian Customs authorities have lately given a decision to the effect that the duty to be imposed on electric stoves is at the rate of 27½ per cent. *ad valorem*, under the general tariff, 25 per cent. under the intermediate, British goods being, however, dutiable at only 15 per cent.

TRADE STATISTICS OF EGYPT, 1912.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1912, is taken from the recently-issued trade statistics. The figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1911.	1912.	Inc. or dec.
Steam engines, including boilers, &c.—	£E.	£E.	£E.
From Great Britain ...	91,000	97,000	+ 6,000
„ Germany	15,000	15,000	—
„ Belgium	1,000	—	— 1,000
„ France	5,000	4,000	— 1,000
„ United States ...	—	1,000	+ 1,000
„ Holland	5,000	2,000	— 3,000
„ Italy	8,900	8,000	—
„ Switzerland ...	4,000	5,000	+ 1,000
„ Austria-Hungary ...	3,000	15,000	+ 12,000
„ Other countries ...	—	3,000	+ 3,000
Total ...	132,000	150,000	+ 18,000
Electric machinery (including gas engines and petrol engines).—			
From Great Britain ...	62,000	78,000	+ 16,000
„ Germany	32,000	32,000	—
„ Austria	2,000	9,000	+ 7,000
„ Belgium	3,000	3,000	+ —
„ United States ...	2,000	7,000	+ 5 000
„ France	8,000	6,000	— 2,000
„ Italy	13,000	12,000	— 1,000
„ Switzerland ...	28,000	32,000	+ 4,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	150,000	181,000	+ 31,000
Other machinery (except agricultural).—			
From Great Britain ...	116,000	88,000	— 28,000
„ Germany	41,000	49,000	+ 8,000
„ Austria	3,000	4,000	+ 1,000
„ Belgium	3,000	4,000	+ 1,000
„ United States ...	48,000	42,000	— 6,000
„ France	37,000	39,000	+ 2,000
„ Italy	4,000	3,000	— 1,000
„ Switzerland ...	10,000	4,000	— 6,000
„ Turkey	2,000	2,000	—
„ Other countries ...	1,000	3,000	+ 2,000
Total ...	265,000	238,000	— 27,000
Railway and tramway carriages.—			
From Great Britain ...	1,000	22,000	+ 21,000
„ Austria	19,000	42,000	+ 23,000
„ Belgium	11,000	28,000	+ 17,000
„ Other countries ...	—	7,000	+ 7.000
Total ...	31,000	99,000	+ 68,000
Lamps of all kinds.—			
From Great Britain ...	8,000	7,000	— 1,000
„ Germany	24.000	20,000	— 4,000
„ Austria	36,000	32,000	— 4,000
„ Belgium	—	1,000	+ 1,000
„ France	7,000	11,000	+ 4,000
„ Italy	1,000	1,000	—
„ Sweden	10,000	6,000	— 4,000
„ Other countries ...	3,000	1,000	— 2,000
Total ...	89,000	79,000	— 10,000
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	7,000	8,000	+ 1,000
„ Germany	15.000	16,000	+ 1,000
„ Austria	7,000	4,000	— 3,000
„ France	13,000	12,000	— 1,000
„ Italy	4,000	3,000	— 1,000
„ Switzerland ...	—	1,000	+ 1,000
„ Belgium	1,000	1.000	—
„ Other countries ...	2,000	1,000	— 1,000
Total ...	49,000	46,000	— 3,000
Electric, telegraphic and telephonic apparatus.—			
From Great Britain ...	50,000	57,000	+ 7,000
„ Germany	22,000	20,000	— 2,000
„ Austria	19,000	26,000	+ 7,000
„ Belgium	11,000	5,000	— 6,000
„ United States ...	1,000	1,000	—
„ France	20,000	13,000	— 7,000
„ Italy	2,000	3,000	+ 1,000
„ Sweden	7,000	5,000	— 2 000
„ Switzerland ...	6,000	3,000	— 3,000
Total ...	138,000	133,000	— 5,000
Scientific instruments.—	1911. £E.	1912. £E.	Inc. or dec. £E.
From Great Britain ...	19,000	17,000	— 2,000
„ Germany	20,000	16,000	— 4,000
„ Austria	2,000	1,000	— 1,000
„ United States ...	2,000	2,000	—
„ France	14,000	13,000	— 1,000
„ Italy	2,000	1,000	— 1,000
„ Switzerland ...	1,000	1,000	—
„ Other countries ...	—	2,000	+ 2,000
Total ...	60,000	53,000	— 7,000
Rails.—			
From Great Britain ...	66,000	35,000	— 31,000
„ Germany	22,000	60,000	+ 38,000
„ Belgium	21,000	21,000	—
„ France	5,000	—	— 5,000
Total ...	114,000	116,000	+ 2,000
Copper, hammered, drawn or sheet.—			
From Great Britain ...	218,000	160,000	— 58,000
„ Germany	7,000	11,000	+ 4,000
„ Belgium	1,000	2,000	+ 1,000
„ France	10,000	11,000	+ 1,000
„ Other countries ...	2,000	—	— 2,000
Total ...	238,000	184,000	— 54,000
Copper manufactured.—			
From Great Britain ...	13,000	17,000	+ 4,000
„ Germany	14,000	16,000	+ 2,000
„ Belgium	1,000	1,000	—
„ France	17,000	18,000	+ 1,000
„ Italy	6,000	7,000	+ 1,000
„ Other countries ...	5,000	2,000	— 3,000
Total ...	56,000	61,000	+ 5,000

£E = £1 0s. 6¼d.

THE ELECTRICITY SHOWROOM.

BY "ATTENDANT."

OF all places of interest and amusement none can compare with an electricity showroom.

Designed entirely for the purpose of advertising the supply company, the showing of new electrical appliances and fittings, and for advocating the general use of electricity, it becomes by force of circumstance converted into a haven and refuge from the weather, an inquiry bureau for any and every subject under the sun, a receiving office for complaints, and has even been used as a medium for practical joking.

The writer, in this short article, is endeavouring to interest his readers by recalling a few of the most amusing incidents which it has fallen to his lot to hear of or to witness.

It has been stated above that the showroom is looked upon by some as a haven in the storm, and it is indeed a fact that not only travellers and contractors, but the public generally often use it for that purpose. Some of these people even go so far as to say that they have just dropped in till the rain has ceased, while others, not so straight-forward, proceed to occupy the attendant in some conversation until the weather outside is more inviting. It is needless to add that these people can always be distinguished from genuine inquirers, for their conversation usually lags, and more often than not bears on any subject other than electricity. Possibly they are under the impression that the duties of an attendant are merely to attend, and they little think that while they are so wasting his valuable time he has other more important matters to deal with.

Sometimes, by way of a charge, persons having no intention of purchasing fittings, or even installing electricity at all, will bounce into the showroom with a question such as this: "Is this the only showroom that you have, or is there another upstairs?" Or they will ask, "Do electric heaters give out heat?" and forthwith proceed to warm their chilled bodies. You can nearly always rely on these people being weather-bound, and, the storm having passed over, or they themselves having been sufficiently warmed, they proceed on their journeys feeling, no doubt, a sense of satisfaction at having patronised the Electricity Department, by visiting their showroom and learning a little of the great value of electricity.

It is, however, as an inquiry bureau that the showroom is at its best. Here are a few of the inquiries, some by personal investigation, others over the 'phone :—

A lady called in a certain showroom one afternoon to inquire if they had any houses to let. Still another lady wanted to know if they sold wedges for windows.

By way of variation, a gentleman rang up to know whether there was any electrical means of maintaining a gas flame at a definite height, and how many heat units there were in a unit of electricity. These may be fairly sensible questions, but they are rather a tax on the average showroom attendant.

Another gentleman called in to know "why two lamps burning in series consumed less electricity than one in parallel." He had in this case been instructed by a local contractor, who merely knew that it was so, but could not give the reason. When the absurdity of the proposition was pointed out to him and the true facts were given, he would not believe it, because he said the company did not like series wiring owing to its economy, and, moreover, it was not to the advantage of the contractor to deceive him.

A "Ratepayer" called in one day, and asked, "Is the electricity undertaking run for the benefit of the ratepayers?" On being told that it was so, he wanted to know why there were no mains in the particular street in which he lived. He was then told that the Council did not lay mains for the mere fun of the thing, and could not undertake to do so unless they received some sort of guarantee that it would not be wasted expenditure. He was not satisfied however. He seemed certain that the Council had some ulterior motive in refusing to lay mains except on these terms, and went away in a wrath promising the attendant that he would hear more of the matter. As it was just before the Council election it seems probable that the gentleman wanted his information for some party purpose, but whether that be so or not, no more was heard of a "Ratepayer."

"Do you want to buy a second-hand gas-engine cheap?" Such was the question that fell on the startled ears of an attendant on one occasion. He replied that the showroom was the property of the Electricity Supply Co., and that they did not deal in gas-engines, much preferring electric motors. But the inquirer was unabashed. "I thought perhaps you could use it to drive some of your electrical motors with," he replied, much to the amusement of the man in charge.

The persons who come to pay the gas account or who want a wick to fit the top of some particular make of oil lamp are innumerable; but there is another type of inquirer who pesters the life out of the average showroom attendant.

The showroom is usually situated in some conspicuous place, and it is, perhaps, for this reason that it becomes the happy hunting ground for so many professional canvassers or cadgers, whichever you like to call them. In any case, they number occasionally anything up to six per day, inquiring "would you like to subscribe to this or that?" As the attendant has to keep up a good personal appearance, it may be that he looks wealthy and prosperous; and if that reason suits the case we have, at least from the attendant's point of view, a sound argument in favour of the simple life.

One naturally expects complaints in a showroom, but some of those received can only be described as exceeding the limit. Take the following as an instance:—A reverend gentleman complained one day that the company in laying the electric light next door had broken the flag at the gateway, thereby causing the gate support to tilt over, so that he (the reverend gentleman) could not open or shut his gate. The attendant thought it unlikely that their workmen had been guilty, since, as he pointed out, they did not in any way touch the stone, but simply ran through under it, at a distance of some 3 ft. below it. But the reverend gentleman persisted; he had, in fact, been pointing it out to everybody, telling them "that is what the electricity people do for you," for quite a long time. On asking what his reverence meant by a long time, the attendant was very surprised to hear that it occurred 10 years ago. The chief engineer, who happened to be standing in the showroom, overheard the remark and took up the case, pointing out that it was hardly in keeping with the gentleman's profession to "slang" the Supply Co. for 10 years, and then ask them to repair what might have been an accident on their part.

Almost as curious was the complaint of the lady who wanted the Supply Co. to alter their voltage to suit a kettle she had picked up cheaply. "Why did not all the companies work at the same voltage?" she asked, and indeed why?

There is plenty of scope for practical joking in a showroom, but the following is an example of the worst kind.

A "lady" one day called at one of our suburban showrooms and giving an address in Park Lane ordered a large quantity of elaborate fittings and appliances, none of which were in stock. The attendant, however, was a bit suspicious, and did not get the goods, and it was as well, for although the "lady" promised to look in again on the following Tuesday, she was neither seen nor heard of afterwards.

The following, although it was taken as a joke, was probably not intended as one. A lady called in with a box containing a small bell and battery which she wanted repaired. She was informed that work of that nature was not undertaken by the department, but out of kindness the attendant offered to look at the job, and finding that it required a new battery told the lady to go to a contractor who would supply her with one. Judge of his astonishment when, a little later in the day, he received the following note: "Mrs. ——— regrets that the ——— Borough Council is not capable of mending her small bell."

The writer has endeavoured to select the best out of an almost limitless supply of incidents, but without doubt there are many more favoured persons who could give experiences which would provide even more interesting reading than the examples selected here. However that may be, no one will venture to dispute that the Electricity Showroom is one of the funniest places ever invented.

PROCEEDINGS OF INSTITUTIONS.

Röntgen Society.

A GENERAL meeting of the RONTGEN SOCIETY was held on June 3rd, when PROF. C. G. BARKLA delivered a lecture on X-ray reflection. This line of work was started, he said, by Friedrich, Knipping, and Laue some months ago in Germany, and these physicists proved that when a beam of X-rays was transmitted through a crystalline structure impressions were obtained on a photographic plate, not only of the direct beam, but of a large number of faint secondary pencils, resulting in a complete interference pattern, as though it might have been produced by a beam of light passing between a series of regularly spaced obstacles. After recounting the work of Bragg, father and son, and others along this line of investigation, Prof. Barkla said that in his own experiments he had used X-rays emerging from a pinhole aperture and projected them through a sheet of rock-salt, 2 mm. in thickness, placed some 40 or 50 cm. from the anticathode. By the effects obtained on a photographic plate after the X-rays had passed through the crystal, he was able to demonstrate that the laws of regular reflection were observed by the Röntgen rays. The reflections obtained were due to the vibrations set up by the impinging waves upon the constituent electrons within the molecules of the crystal surfaces, and from this point of view a crystal surface was different from a surface of mercury or of any polished metal. The X-rays were not reflected regularly from a surface of mercury, because such a surface, although appearing to be a plane, had in reality irregularities of molecular structure which were large as compared with the wave-length of the Röntgen radiation. Every molecule in a surface, on being submitted to the X-ray beam, sent out a train of rays: but unless certain relations held as to the distance between molecule and molecule, there would be destructive interference, with consequent effacement of the effect. In a crystal, however, the molecules were arranged perfectly in definite planes, giving a surface of sufficient regularity to produce regular reflection. Prof. Barkla showed a large number of photographic results with selenite, tourmalin and other crystals, and pointed out the arrangement of the numerous secondary pencils around the central opaque patch, which was due to the direct beam. The intensity of these secondary reflection effects was in no case, he said, near 1 per cent. of that of the primary, but the phenomena were sufficient to prove that the X-rays were regularly reflected exactly like light from the planes in the crystal. Dr. R. W. A. Salmond also read a short paper on a cognate subject, expressing the view that in crystallography was to be found the most promising field for X-ray investigation, and the chairman (Mr. Duddell), in summing up the discussion, said that, it having been proved that X-rays could be reflected, they would probably be found capable of being refracted, approximating to light in their properties, so that there would be no further need to call them "X"-rays.

Municipal Tramway Managers.

ANNUAL CONFERENCE AT SUNDERLAND.

THE annual Conference in connection with the Managers' Section of the Municipal Tramways Association, was held in the Town Hall, Sunderland, on Thursday and Friday last week. Between 50 and 60 delegates attended the opening session, which was presided over by Mr. A. R. Fearnley. A detailed description of the methods under which the Sunderland system is worked was given by the general manager (Mr. A. R. Dayson), who, at the close of his address, was closely questioned in regard to transfer tickets, which are extensively used in all sections of the system. During the debate, it transpired that not more than 8 per cent. of the municipal tramway systems in the kingdom utilise the transfer ticket, and the general opinion of the Conference was against any further extension of its use on the ground that it tended greatly towards the encouragement of fraud both on the part of conductors and passengers.

A paper on the "Interim Report of the Rail Corrugation Committee," read by MR. R. H. WILKINSON, was discussed at considerable length. The general trend of opinion was that the vibration theory would prove the most likely in regard to the cause, and the Special Sub-Committee dealing with the question was requested by resolution to pay particular attention to this phase of the problem.

Under the presidency of the Mayor (Alderman Richardson), the delegates were entertained to luncheon, and in replying to the toast of the "Municipal Tramways Association," MR. FEARNLEY said that that body fully realised the responsible position they now filled. They represented a capital of 55 millions sterling invested in municipal tramways, which were returning an aggregate revenue of 12 millions per annum. A few years ago the numbers of passengers carried by railways and tramways were about equal, but last year the latter carried double the number of passengers accounted for by the former.

A sea-trip along the coast of Durham and Northumberland followed, after which the delegates were landed at South Shields, and there the delegates partook of tea in the Town Hall as guests of the Mayor (Councillor J. W. Henderson). In the course of a brief speech his WORSHIP illustrated the advantage of a municipal tramway service over one controlled by private enterprise, so far as the community were concerned, by quoting the experience of South Shields. In the early days of their system they received invaluable advice and assistance from the neighbouring borough of Sunderland, which could not have been given or expected had the tramways there

been in the hands of a private company. A cruise up the Tyne, past the Elswick Works of Armstrong, Whitworth & Co., concluded the day's entertainment.

Practically the whole of Friday morning was devoted to the discussion of a paper by the secretary, Mr. C. J. Spencer (Bradford), on "Petrol and Trackless Trolley Vehicles." At the outset Mr. Spencer said he tackled the question with an absolutely open and unprejudiced mind. It was common ground that some cheap form of transit was needed in many districts where tramways proper were prohibitive owing to the heavy capital expenditure. That fact was amply proved by the great number of applications before the current session of Parliament for railless trolley and motor-omnibus powers in various parts of the country, even having full regard to the uncertainty of the law on the question of who was to bear the full burden of road maintenance. He did not doubt for a moment that if that question could be satisfactorily settled without any very serious burden being thrown upon either motor-omnibus or railless trolley operators, there would be an enormous development of these means of transit throughout the country. Speaking from the public point of view regarding both railless trolley vehicles and motor-omnibuses, he would wipe out of consideration the experiences with the very early types and consider what they might reasonably expect with vehicles constructed in the light of modern experience and capable of efficiently providing public service. The modern motor-'bus certainly did not run so smoothly as a rail-borne-car and could not be expected to do so. With the motor-'bus the noise of moving machinery was reduced to a minimum, and with proper maintenance and care should not exceed the tramcar in that respect. But whatever might be the case at present, it should be possible to construct railless trolley vehicles to run more quietly and with less vibration than motor-omnibuses. The absence of spur-gearing, or chains, in the case of future railless trolley-cars was bound to result in less vibration and noise, and consequently smoother running, than could possibly be the case with the internal-combustion types. On the other hand, the motor-omnibus had no trolley pole, and consequently no hissing noise from that source, and it might be admitted by even the railless trolley bigoted expert that the petrol omnibus did not need to stick to a silly groove, but could wander over fields, hedges and pavements at its own sweet will. With regard to convenience and facility of operation, it had been argued that there was a considerable advantage in a railless trolley extension system in connection with an existing tramway system of considerable size, on account of the fact that after all a railless trolley-car was little more than a tramcar running on road wheels, the overhead equipment being the same. On the other hand, if a small number of motor-'buses were purchased the position was altered; their design was altogether different from a tramcar, their inspection and maintenance were of a far higher order and quite another type of fitter and staff was required to handle them, and, where their number was small, it was difficult to get the fullest economy and efficiency from a special staff. In regard to traffic expenses, he submitted that an average figure in a semi-industrial area would be 2·67d. for the motor-'bus and 2·5d. per car-mile for the railless-trolley vehicle, the extra ·17d. in regard to the motor-'bus being for lubrication. Under the head of general expenses they might fairly assume that, with two exceptions, all were common to both. As the law stood at present the rates on railless trolley-cars were in excess of those paid for omnibuses. So far as his knowledge went, the railless trolley-car would be rated on its revenue-earning capacity and the petrol omnibus on the rateable value of the garage. What the ratio of these two figures really was he could not say. On the other hand, he thought it might be fairly argued that the liability to accident with a railless trolley-car was less than with a motor-omnibus, and certainly the amount paid for fire insurance would be higher in the case of the motor-omnibus. After discussing general repairs and maintenance, which he estimated at 1·79d. for the railless trolley-car and 2·24d. for the motor-omnibus, and power at 2d. per car-mile for petrol and 1d. for electric energy, he summed up the total cost per car-mile of running the respective vehicles as 6·09d. for the railless trolley-car and 7·71d. for the motor-omnibus. Turning to capital costs, he argued that the petrol vehicle was, and would continue to be, the most expensive, and if they took its useful life at 100,000 miles and the capital cost at £850, with a life of five years, they would have to pay a sum of 2·27d. per car-mile for interest and depreciation charges. In the case of the railless trolley £750 should be a fair cost of the vehicle, and with a life of 10 years, or 200,000 miles, the cost per car-mile in interest and depreciation charges would be 1·09d. Thus they had a total cost, including capital charges of 9·98d. for the motor-omnibus and 7·18d. for the railless trolley car.—Mr. J. W. Hame next submitted a paper on "The Standardisation of Specifications for Tramcar Equipments," after discussing which the Conference terminated with a brief meeting of the Executive Council.

Oxygen and Hydrogen.—Referring to the article in our issue of May 16th on "The Commercial Production of Oxygen and Hydrogen" with the I.O.C. electrolytic plant, the British manufacturers, MESSRS. ARTHUR LYON & CO., ask us to state that their address is 608, Caxton House, Westminster, S.W.

Anglo-German Exhibition. — The Lord Mayor of London opened this Exhibition at the Crystal Palace on Wednesday.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"ANXIOUS" writes:—"I am desirous of erecting private overhead telephone wires in a town, but am informed that it is necessary to obtain permission from the Postmaster-General. Will you kindly say if such is the case, and if so, is it necessary to pay an annual wayleave?"

*** It is well-settled law that the telephone is part of the monopoly of the Postmaster-General, and that it can only be used under licence from him. Even the late National Telephone Co. were his licensees. The only exception to the rule is that a man may sometimes have a private telephone between one part of his business premises and another, or between his house and his business premises; but in that case he must obtain wayleaves from private persons over whose property he carries his wires.

"UNIT" writes:—"I received an order for a small plant complete with wiring for a certain number of lights. During the progress of the work additional lights were added, by the client's instructions, to quite twice the original number. This necessitated a larger engine, dynamo and battery, which was put in also to the client's verbal instructions, and now that the account has been sent in he refuses to pay. I might say that the account is quite twice the amount of my original estimate. I am quite agreeable to have an independent valuation made, but this the client will not entertain."

*** It is not easy to give a satisfactory answer to this query without access to the documents. Assuming, however, that a certain number of lights of a certain candle-power were specified, it is manifest that "Unit" was only obliged to provide an engine, dynamo and battery of sufficient capacity for the purpose. If, as is apparently the case from the statement of the facts, the employer not only ordered the extra lights, but the engine, &c., of greater power, it is clear that a new contract has come into existence, which "Unit" can enforce, by suing on what the lawyers call a *quantum meruit*. It should be observed that the mere *assent* of an employer to alterations is not generally sufficient. So in the case of Lovelock *v.* King, 1831, 1 Mov. and Rob. 60, a carpenter had agreed to alter certain premises for a fixed sum. Considerable deviations were made from the original plan, which it was alleged the employer had seen and not objected to. The carpenter sued for the "measure and value" price of all the work done. It was laid down that the employer was not liable for any larger sum than that paid by the contract, by reason of his assenting to deviations, unless he was expressly or impliedly informed that such deviations would increase the cost.

"TROP" writes:—"The supply of energy over a considerable area is controlled by a public supply company; this company supply to a works in a village about 6 miles distant a load of about 200 KW., where it is transformed and converted to 220-volt D.C. and 440 A.C. The village authority are taking up the question of lighting the streets, and are met at the outset by a rival company promoted by certain officials of the works mentioned. The Council maintain that the works supplied by the supply company, who would thus become secondary supply authority, would be benefiting themselves on account of lower price obtainable for larger quantity of power passed through. Do you consider it would be within the legal right of the Council to insist on the supply authority giving a supply independently of the works mentioned, and is there a statute price of current which the suppliers (whoever they may be) are bound to accept?"

*** This is a problem which, in one form or another, has frequently been discussed in this REVIEW. It is evident that those who control the works in the village intend to take current at one price from the supply authority and farm it out in the village at a profit. It is very much in doubt whether this is legitimate, but it appears to be a question as between the supply authority and the works, not as between the village Council and the supply authority. If the latter body is not sufficiently vigilant to prevent a supply being transformed and used in this way, that appears to be a matter for the shareholders or ratepayers to take up.

As to the second question put by "Trop," this is clearly answered by Sec. 19 of the Electric Lighting Act, 1882, which provides that "where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided for by the terms of the licence, order, or special Act authorising such supply, every company or person within that part of the area shall on application be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply."

The Holidays.—THE GREAT EASTERN RAILWAY CO. have issued a handbook, "On the East Coast," giving prominence to some of the less known parts of East Anglia and to the country between the Cromer and Hunstanton coast and the Norfolk Broads. The book, which is attractively illustrated in colour, can be obtained free from the superintendent of the line, Liverpool Street Station, London, E.C.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

TRINIDAD AND TOBAGO.—In accordance with the terms of the Canadian-West Indies Treaty, it is proposed to revise the Tariff of Trinidad and Tobago for the purpose of establishing a system of preferential duties on British (and Canadian) goods as against foreign goods. The new Tariff will come into force at a date to be fixed later, and the following are some of the new rates which will affect readers of the ELECTRICAL REVIEW :—

	Preferential tariff.	General tariff.
Glass and glass ware, lamps, &c.	8 % ad val.	10 % ad val.
Electric machinery not provided for below, and electric dental appliances	8 % „	10 % „
Iron wire...	8 % „	10 % „

The following are to be admitted free of duty :—

Articles imported by or for the use of the Colonial Government ; electric lighting and power plant on estates or mines ; plant for railways and tramways on estates or mines, including rails and rolling stock ; mining plant of all sorts, including machinery and pipes for the sinking of oil and artesian wells.

CANADA.—The Canadian Customs authorities have issued revised regulations as to the Customs treatment of samples imported into the Dominion which it is intended subsequently to re-export. These revised regulations read as follows :—

1. Samples of dutiable goods, solely for use in taking orders for merchandise, imported temporarily into Canada direct by non-residents from any British country, may be admitted upon deposit of a sum equal to the duty, to assure the re-exportation of such samples within one year.

2. A temporary entry of such samples, in duplicate, with certified invoices annexed in the usual form, shall be presented to the collector of Customs at the port of entry.

The importer shall make and subscribe to a declaration on the face of the temporary entry that the goods described therein are *bonâ fide* samples for use only in taking orders for merchandise and to be re-exported within 12 months.

3. When the samples are marked by a Customs officer for identification and the temporary entry duly completed, the collector may issue his permission for the release of the samples, upon receiving from the importer a sum of money equal to the duty, so as to assure the re-exportation of all the samples.

4. The permission for the release of the sample goods shall be in duplicate, with a notation thereon that the money deposited with the temporary entry of samples shall be returned to the importer, provided the whole of the said samples be exported within 12 months from the time of entry, with proof of such exportation furnished to the satisfaction of the Collector.

One copy of the temporary entry, with invoice and permission annexed, shall be delivered to the importer, so that the same may be presented to the Customs Officer when samples are re-exported.

NOTE.—The foregoing privilege does not extend to articles which, owing to their quality or value, or which, owing to their nature, could not be identified upon re-exportation.

UNITED STATES.—With reference to the recent decision of the United States Customs authorities regarding the admission free of duty of materials for the construction or repair of vessels built in the United States, and of all such materials as are necessary for the building or repair of their machinery, it has now been decided that electric light bulbs and fixtures for vessels, and ship telegraph and signalling apparatus and telegraph and telephone apparatus on naval vessels for controlling gun fire, constitute articles of outfit and equipment which are admitted free of duty.

PATENTS EXPIRING IN 1913.

(*Continued from page* 964.)

13,646. "Electric motors." T. D. HOLLICK. July 1st.—Relates to means for stopping, starting, reversing, and varying the speed of electric motors used for driving cranes, hoisting-gear, and other machinery, or for electric traction. The armature and field magnets are arranged so as to rotate in opposite directions, the field magnets being supported by a sleeve on the armature spindle. The gearing is such that if the field magnets are stopped by applying a brake to the drum, the armature will drive the pulley at half its own speed. Similarly, the armature may be stopped by a brake acting on a drum, in which case motion in the opposite direction is derived from the field magnets.

14,304. "Motor road vehicles." W. P. THOMPSON. (Cantono, E.) July 11th.—Relates to the application of electric motors to automobile vehicles, especially motors, in which the power is regulated by varying the excitation of the field magnets. The invention comprises a series-parallel controlling system, a switch acting in conjunction with both the electric controller and the mechanical means for operating the fore-carriage, and a resilient worm driving gear for facilitating the starting of heavy vehicles without shock.

14,703. "Electric lamps." H. BREMER. July 17th.—Electrodes are made of carbon uniformly mixed with luminiferous matter, such as alkaline earths or calcium carbonate, fluoride, or silicate, to increase the production of light, and are coated with material adapted to form a fused slag therewith, this dropping off near the arc. The coating also protects the carbons from the air. Suitable coatings are produced by electroplating with metal or by dipping red-hot carbons in fused boric acid, borax or a neutral or acid borate or alkaline silicate.

14,704. "Electric lamps." H. BREMER. July 17th.—Electrodes are made of carbon mixed with large proportions of salts of calcium, magnesium, strontium or other metals, to increase the production of light, and such that the electrodes contain at least 5 per cent. of fluorine, iodine or bromine to form fusible slags with the bases, which fall off in small drops near the arc. Calcium fluoride and cryolite are most suitable.

15,418. "Electric conductors." H. EDMUNDS. July 27th.—Conductors are coated with spirals of paper, and are finally saturated with a mixture of sealing and waterproofing compositions. Coverings of braided jute, &c., or final armourings may also be employed. The paper strips employed are saturated with (1) a sealing or waterproofing composition consisting of a mixture of resinous matter, such as colophony, and oxidised oil, such as blown vegetable or fish oil, and (2) an oily matter, such as a heavy mineral oil, with or without mineral wax.

16,005. "Incandescent lamps." A. SWAN. August 5th.—Bulbs are attached to stems carrying the leading-in wires and filaments, and their necks are expanded either in moulds so that they will fit caps, or directly in indented caps, by the machine described in the specification.

16,960. "Rheostats and switches." C. DE KANDO. August 21st.—A liquid resistance is controlled pneumatically, together with a short-circuiting switch. Electrodes are fixed in a vessel, in which is a bell, the vessel and bell normally communicating through a valve, so that the resistant liquid stands level in them, below the electrodes. Compressed air may be admitted from a reservoir, to close the piston valve in opposition to a spring.

16,961. "Electric tramcars, &c." C. DE KANDO. August 21st.—Relates to electric motors or motor casings for tramway vehicles and the like in which the motors are disposed on the wheel axles. While retaining the largest possible diameter for the rotating parts in order to preserve a high circumferential velocity, the motor casing is brought within the limited space allowed between the lower part of the car and the rails by official regulations by forming or cutting it horizontally.

17,386. "Electric switches." M. GUETT. August 28th.—Switches giving a quick make and break. The contact lever carrying the contacts is pivoted at one end, and is formed with shoulders c^1, c^2. The tumbler-lever is formed with two shoulders g^1, g^2, the former engaging with the contact-lever, and the latter with a spring, which also embraces the shoulder c^1. On moving the handle the spring is put in tension until the shoulder g^1 clears the shoulder c^2, when the spring snaps the switch off. The shoulder g^1 then passes sufficiently below the shoulder c^2 to hold up the contact-arm.

17,786. "Telegraphic apparatus." S. G. BROWN. September 2nd.—Relates to translating or receiving telegraph apparatus in which the periods of + and − currents received in submarine telegraphy are broken up into their initial impulses for retransmission either directly with or without curb currents, or by means of a perforated strip, the strip being the form in which the message is received.

18,457. "Tramcars." J. TIDSWELL. September 13th.—Obstruction removers for electric and other tramcars. Should the hinged "feeler" meet an obstruction a pivoted catch is released, and allows a bell crank to lower the spring fender close to the track. The "feeler" is reset by depressing a pedal.

20,655. "Electrical conduits, drain pipes, &c." ALBION CLAY CO. and R. LAWTON. October 14th.—Relates to apparatus for moulding the spigot and socket ends of drain pipes and multiple conduits. The spigot end of the conduit is inserted in a mould mounted on a base-plate, and a core is lowered down on guide rods into the centre of a socket. Bituminous composition or cement is then introduced between the mould and core and the ends of the pipe to form a spigot and socket accurately in line with one another.

21,354. "Electric winding-mechanism." H. ARON and ARON ELECTRICITY METER, LTD. October 25th.—Relates to improvements in mechanism for winding up, or giving tension to, driving-springs. The arm carried by the swinging armature and insulated from it, is provided with two pins. The driving-spring is connected to one pin and conveys the current from the energising coil. The other pin makes and breaks the circuit. An adjustable cylinder fixed by a screw, serves to adjust the tension of the spring, and thereby control the play of the return stroke of the armature.

21,355. "Electricity, measuring." H. ARON and ARON ELECTRICITY METER, LTD. October 25th.—Work supplied on a four-wire three-phase alternating system is measured by a pendulum or motor meter in either of two ways. The mains may be connected in any way, and unequally loaded. In one arrangement, the three principal mains contain stationary coils A, B, C, influencing two pendulums, which carry coils connected between the two mains A, B, and the fourth or "neutral" mains D ; the effects of the coils A, B on the pendulums are summed, but the middle coil C is placed and connected so that it reduces the effects of both coils A, B.

21,637. "Electric lamps." H. BREMER. October 30th.—Rods are made of angular sections, of mixtures of powdered carbon with large proportions of powered metals or metallic salts, to produce incandescent vapours, and with the addition of 1 per cent. or more of boron, liquid fluorine, or other material to render metallic accumulations sufficiently fusible to drop off the edges of the rods. The light may be coloured by a further addition of 25 per cent. of fluorine bromine, or iodine, or magnesia. Opposite edges of the rods may be notched at intervals to cause the breaking off of projecting corners, if the arc burns inward.

(To be continued.)

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,208. "Electrolytic cells." E. C. R. MARKS. (Hooker Electrochemical Co., United States.) May 26th. (Complete.)

12,218. "Means for automatically operating electrical switches for stopping and restarting motors for compressing air and other fluids into cylinders and other receivers." T. C. WALTER and DISPLAYER CO., LTD. May 26th. (Complete.)

12,235. "Electrically-driven automatic lathes." H. KIENZLE. May 26th. (Complete.)

12,238. "Extensible electric light fixtures." F. GARRECHT. May 26th. (Complete.)

12,246. "Electric sadiron." W. H. DALTON. May 26th. (Complete.)

12,253. "Metal filament incandescent electric lamps." EHRICH & GRAETZ. (Convention date, April 4th, 1912, Germany.) May 26th. (Complete.)

12,311. "Magnetic separators." H. H. THOMPSON and A. E. DAVIES. May 27th.

12,335. "Telephone receiver or transmitter." E. RYAN and H. W. BROWN. May 27th.

12,368. "Magnetic separators." H. J. H. NATHORST. (Convention date, June 4th, 1912, Sweden.) May 27th. (Complete.)

12,377. "Manufacture of stable boron nitride." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 27th.

12,404. "Means for securing shades, reflectors or other attachments to electric lampholders and the like." G. ST. J. DAY. May 28th.

12,417. "Wire-drawing apparatus." G. WATSON, and W. and D. HOUGHTON AND CO., LTD. May 28th. (Complete.)

12,421. "Manufacture of tungsten metal bodies." C. GLADITZ. May 28th.

12,423. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.

12,424. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.

12,425. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.

12,426. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,592, 1912. July 8th.) May 28th.

12,428. "Automatic electric contact apparatus." V. VON VANGEL. May 28th.

12,437. "Means for electrically indicating or counting revolutions of shafts, axles and the like." SIEMENS BROS. & CO., LTD., and F. HIRD. May 28th. (Complete.)

12,444. "Electric furnaces." COMPAGNIE POUR LE TRAITEMENT DES METAUX ET DES MINERALS PAR L'ELECTRICITE. (Convention date, January 10th, 1913, France.) May 28th. (Complete.)

12,461. "Electric radiator." A. H. BRACKENSIECK. May 28th.

12,463. "Reflectors for electric lamps." C. C. REGNART. May 28th.

12,471. "Vapour electric devices." F. CONRAD. (Convention date, June 21st, 1912, United States.) May 28th. (Complete.)

12,477. "Governing mechanism for engines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 28th.

12,499. "Means and method of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,853 of 1911.) May 29th.

12,527. "Means for indicating or recording or indicating and recording when a storage battery has been charged or discharged to a desired limit." R. RANKIN and ELECTRICAL POWER STORAGE CO., LTD. May 29th.

12,544. "Shade or globe for electric light bulbs." N. S. CORNEY. May 29th.

12,565. "Inductance coils for telephone or other circuits." SIEMENS AND HALSKE AKT-GES. (Convention date, May 29th, 1912, Germany.) May 29th. (Complete.)

12,566. "Circuit arrangements for telephone systems." SIEMENS BROS. AND CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 29th. (Complete.)

12,575. "Electric arc lamps." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) May 29th. (Complete.)

12,578. "Electrical regulating systems." W. J. MELLERSH-JACKSON. (United States Light and Heating Co., United States.) May 29th. (Complete.)

12,587. "Method and means whereby equalisation of light from an artificial illuminant is obtained." S. MADDICK. May 30th.

12,628. "Automatic electrical advertising writing reproducer." L. J. COLEBROOK. May 30th.

12,635. "Arrangements for eliminating irregularities in electric signalling." A. ORLING and ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. May 30th.

12,638. "Apparatus for transmitting synchronous movements by rotating magnetic field." R. FEDERICO and L. SEGALIN. (Convention date, May 31st, 1912, Italy.) May 30th. (Complete.)

12,639. "Apparatus for use in charging electric accumulators." H. LEITNER. May 30th.

12,651. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT.-GES. (Convention date, July 8th, 1912, Germany.) May 30th. (Complete.)

12,658. "Automatic light-extinguisher." L. RADET. (Convention date, July 17th, 1912, France.) May 30th. (Complete.)

12,670. "Means for adjusting the accumulators of electric safety lamps on charging benches." P. WOLF. May 30th. (Complete.)

12,672. "Means for and methods of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,853/11.) May 31st.

12,695. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG and G. PEGG. May 31st.

12,710. "Circuit-breakers and the like for the protection of alternating-current induction electric motors." G. ELLISON. (Addition to 13,285/07.) May 31st. (Complete.)

12,723. "Testing insulation and other purposes." EVERSHED & VIGNOLES, LTD, and S. EVERSHED. May 31st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

SYSTEM FOR THE ELECTRICAL REGULATION OF CLOCKS AND THE LIKE. L. J. Aron. 23,590. October 15th. (October 16th, 1911.)

RECEPTION OF ELECTRIC WAVES IN WIRELESS TELEGRAPHY. R. Goldschmidt. 23,734. October 17th. (October 18th, 1911.)

ELECTRICAL HEATING UNITS. E. C. R. Marks. (Landers, Frary & Clark.) 24,776. October 29th. (Divided application on No. 10,029 of 1912, April 27th.)

IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. E. Podlesak. 25,646. April 30th. (Divided application on No. 10,209 of 1912, April 30th.)

POCKET IGNITERS. E. Jabreiss. 26,861. November 16th.

THEFT ALARM BOXES AND THE LIKE. R. M. Brydone. 27,002. November 23rd.

ELECTRIC LAMPS FOR AUTOMOBILES. J. Gallay. 27,783. December 3rd.

SIGNAL LAMPS FOR AUTOMOBILES AND THE LIKE. W. J. Mellersh-Jackson. (Wright.) 29,074. December 17th.

PRIMARY GALVANIC CELLS. J. A. E. Achenbach. 29,847. December 27th.

METHOD OF, AND MEANS FOR, HEATING WATER AND OTHER MEDIA OR FLUIDS. G. G. Bell. 2,873. February 3rd.

ELECTRIC RAILWAY SYSTEMS. K. E. Stuart. 2,957. February 5th.

ELECTRIC LAMPHOLDERS. H. Hale. 7,552. March 28th. (September 30th, 1912.)

REGULATION OF THE FREQUENCY PRODUCED BY POLYPHASE INDUCTION GENERATORS. Siemens-Schuckertwerke Ges. 8,070. April 3rd. (April 3rd, 1911.)

METHOD OF, AND APPARATUS FOR, MOULDING SILICON AND SILICON ALLOYS, AND THE APPLICATION OF THE PRODUCTS AS ELECTRIC RESISTANCES AND HEATERS. G. Gualtierrotti. 10,657. May 4th.

MEANS FOR ESTABLISHING ELECTRICAL COMMUNICATION BETWEEN SHIPS AND OTHER VESSELS AND THE SHORE. A. G. Possolo. 10,701. May 6th.

ELECTRIC INCANDESCENT LAMPS AND LAMPHOLDERS. J. Stone & Co., Ltd., and A. C. T. Myers. 10,959. May 8th.

ELECTRIC SWITCHES. A. H. F. Perl. 11,051. May 9th.

ELECTRIC ARC WELDING. A. P. Strohmenger. 11,079. May 9th. (Addition to No. 1,274 of 1912.)

GRADED SERVICE AUTOMATIC TELEPHONE SYSTEM. H. Baron. (Heimann.) 11,261. May 11th.

ELECTRICAL MEASURING APPARATUS OF THE MOVING COIL TYPE. W. H. Apthorpe and Cambridge Scientific Instrument Co., Ltd. 11,279. May 11th.

REMOTE CONTROL FOR ELECTRICALLY-OPERATED APPARATUS. W. P. Thompson. (Ateliers de Constructions Electriques de Charleroi.) 11,537. May 15th.

DEVICES FOR SETTING THE SELECTIVE CONTROLLING APPARATUS ON A MOVING AUTOMATIC GOODS CONVEYOR OR TRUCKER FROM A FIXED STATION. L. Rottenburg and New Transport Co. 11,681. May 16th.

ECONOMISERS OR SHIELDS FOR MULTIPLE ARC LAMPS. Ges. fur Maschinen- und Metall-Industrie. 11,842. May 18th. (May 19th, 1911.)

ARRANGEMENT OF RECEIVING STATIONS FOR WIRELESS TELEGRAPHY. Capt. Z. Dan and G. Rothlander. 12,444. May 25th.

TESTING OF ENGINES. Electric and Ordnance Accessories Co. and J. Etchells. 13,982. June 15th.

METHOD OF, AND APPARATUS FOR, THE PRODUCTION OF ALTERNATING CURRENTS OF HIGH FREQUENCY. H. Sefton-Jones. (Ges. fur Drahtlose Telegraphie.) 14,390. June 19th.

MEANS FOR OBTAINING TWO SEPARATE AND OPPOSITE DRIVES FROM A SINGLE ELECTRIC MOTOR. H. T. Holmes and J. Kemp-Welch. 14,550. June 21st.

HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. R. Wankmüller. 14,750. June 24th.

LEADING-IN CONDUCTORS FOR SEALING INTO ELECTRICAL APPARATUS. British Thomson-Houston Co., Ltd. (General Electric Co.) 15,842. July 1st.

PHOTOMETERS. Siemens Bros. Dynamo Works, Ltd., and S. H. Callow. 15,660. July 4th.

FIRE ALARMS. A. Kirk and C. J. Baker. 15,676. July 4th.

SELECTOR SWITCHING DEVICE FOR AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE. Telephon Apparat Fabrik E. Zwietusch & Co. Ges. 16,151. July 10th. (January 18th, 1912.)

APPARATUS FOR PROJECTING ON TO A SCREEN IMAGES OF OBJECTS WHICH MAY BE OPAQUE TO LIGHT. W. H. S. Marriott. 16,542. July 15th. (Cognate application No. 123 of 1913.)

LOUD-SPEAKING ATTACHMENT FOR TELEPHONES. H. W. Prance. 17,357. July 26th.

COMBINATION OF SUBSTANCES FOR USE AS CATTLE FOOD, OR FOR INSULATING PURPOSES, AND FOR THE PREPARATION OF COATED FABRICS AND ARTIFICIAL BOARDS. A. S. Rowe. 17,554. July 29th.

MARINERS' COMPASSES. L. W. P. Chetwynd. 17,768. July 31st.

ELECTROLYTES FOR USE IN ELECTROMETALLURGY. N. H. M. Dekker. 17,836. August 1st.

ELECTRICALLY-HEATED KETTLES, SAUCEPANS AND THE LIKE. G. H. Collins and H. F. Collins. 18,911. August 19th.

INCANDESCENT ELECTRIC LAMPS. C. Joly. 20,861. September 6th.

CALCULATING APPARATUS PARTICULARLY ADAPTED FOR RECKONING OUT CHARGES FOR THE USE OF ELECTRICITY, GAS, WATER AND SO FORTH. H. Bruckmann. 21,448. September 20th.

DYNAMOS. J. Polkey and George Polkey, Ltd. 22,500. October 3rd.

LEAD ALLOYS FOR TAPES. Western Electric Co. (Western Electric Co.) 25,090. November 1st.

SOURDINES OR DAMPERS FOR TELEGRAPH OR TELEPHONE CONDUCTORS. R. Schaeffer. 25,449. November 6th.

SUPPORTS FOR COLLECTOR POLES FOR USE WITH AERIAL CONDUCTORS. C. L. Delachaux. 25,577. November 7th. (December 4th, 1911.)

ELECTRIC ELECTRODE FURNACES. Jössingfjord Manufacturing Co., A/S. 26,165. November 14th. (April 4th, 1911. Divided application on No. 8,193 of 1912. April 4th.)

TILTING ARRANGEMENT FOR METALLURGICAL FURNACES. Jössingfjord Manufacturing Co., A/S. 26,166. November 14th. (April 4th, 1911. Divided application on No. 8,193 of 1912, April 4th.)

APPARATUS FOR USE IN FORMING JOINT ENDS ON ELECTRICAL CONDUITS, DRAIN-PIPES AND THE LIKE. R. Lawton. 27,510. November 29th.

ELECTRIC INCANDESCENT LAMPS. M. Sidon. 27,813. December 2rd.

APPARATUS FOR COOLING INCANDESCENT WIRE AND LIKE ROLLED GOODS. G. Moller and J. Konig. 27,950. December 4th. (December 4th, 1911.)

NON-SHUNT ELECTRIC ARC LAMPS. W. Rodgers and G. Rowe. 28,627. December 12th.

MANUFACTURE OF NEGATIVE ELECTRODES FOR SECONDARY ALKALINE CELLS. H. P. R. L. Porscke and J. A. E. Achenbach. 29,848. December 27th.

METHOD OF REFORMING, VULCANISING AND SIMILARLY TREATING INDIA-RUBBER. T. Gare. 8,554. April 11th.

APPARATUS FOR THE PRODUCTION OF OZONE. W. Dubilier. 11,090. May 9th.

MANUFACTURE OF ELECTRIC RESISTANCE BODIES. G. Cooper. 11,380. May 13th.

MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES (MORE ESPECIALLY THOSE OF MOTOR-CARS OR THE LIKE) AND FOR GENERATING ELECTRICITY FOR LIGHTING OR OTHER PURPOSES. W. H. Scott. 11,388. May 13th.

SYSTEM OF FIRE CONTROL FOR SELF-PROPELLED TORPEDOES. H. W. Shonnard. 11,459. May 14th.

METHOD OF, AND MEANS FOR, CLOSING ELECTRIC CIRCUITS. G. C. Pillinger and L. Sunderland. 11,486. May 14th.

ELECTRIC SWITCHES. P. V. Hunter and W. L. Shand. 11,586. May 15th.

VAPOUR ELECTRIC APPARATUS. E. E. Darmois and M. A. E. Leblanc. 11,870. May 18th.

TELEPHONE SYSTEMS. E. A. Mellinger. 11,964. May 20th.

MERCURY VAPOUR LAMPS. P. G. Triquet. 12,270. May 23rd. (August 30th, 1911.)

CAB AND TRACK SIGNALLING APPARATUS. J. Treacher. 12,538. May 28th.

RAILWAY SIGNALLING APPARATUS. J. Stitt. 12,649. May 29th.

BI-POLAR FORM-WOUND ROTOR WINDINGS FOR DYNAMO-ELECTRIC MACHINES. H. Schneider. 12,766. May 30th.

AUTOMATIC ELECTRIC THERMAL CONTROL. S. L. R. Price. 16,178. June 28th.

ELECTRIC HEATER. H. W. Purle. 15,429. July 2nd.

PRODUCTION OF MAGNETIC OR ELECTRIC FIELDS APPLICABLE FOR CHANGING THE FREQUENCY OF ALTERNATING CURRENTS AND FOR OTHER PURPOSES. M. Plohl. 15,774. July 5th. (July 11th, 1911.)

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ELECTRIC FURNACES FOR FIXING NITROGEN FROM THE AIR. G. Harker and E. K. Scott. 866. January 11th.

APPARATUS FOR CONTROLLING MOTION FROM A DISTANCE, APPLICABLE MORE PARTICULARLY TO THE CONTROL OF SEARCHLIGHTS OR PROJECTORS, STEERING GEAR AND THE LIKE. Siemens-Schuckertwerke G.m.b.H. 1,047. January 14th. (July 24th, 1912. Addition to 956 of 1912.)

INSULATING SECTIONAL IRON MASTS. Siemens Bros. & Co., Ltd., and G. W. Perry. 1,899. January 23rd.

RAILWAY OR LIKE SIGNALLING OR INDICATING SYSTEMS AND APPARATUS THEREFOR. K. E. Stuart. 3,588. February 5th. (Divided application on 2,957 of 1912, February 5th.)

FIELD MAGNETS FOR DYNAMO-ELECTRIC MACHINERY. Siemens-Schuckertwerke G.m.b.H. 3,627. February 12th. (February 17th, 1912.)

ELECTRIC REGULATING LIQUID RESISTANCES. H. C. E. Boutard. 3,855. February 14th.

TRANSMITTERS FOR USE IN WIRELESS TELEGRAPHY. J. Sahulka. 6,479. March 15th. (March 16th, 1912.)

ELECTRIC MOTOR METERS. H. Aron Elektricitatszahlerfabrik Ges. 792. January 10th. (August 28th, 1912.)

DISTRIBUTOR FOR ELECTRIC IGNITION IN INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 5,532. March 5th. (April 12th, 1912. Addition to No. 9,840 of 1911.)